Donlin Gold Project

Wetland Functional Assessment Methodology

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Wetland Study Historical Overview

Three Parameters Plus has been working on Donlin since September of **1996**, when the first site visit reviewed the then proposed Lyman Road.

During this brief visit 34 sites were evaluated for vegetation and soil types, or photographed for winter air photo interpretation work. It snowed a foot the day after I arrived…

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From **1997-1999** Placer Dome U.S. (PDUS) initiated an advanced identification project to map approximately 9,000 acres

349 Additional Field Plots Acquired

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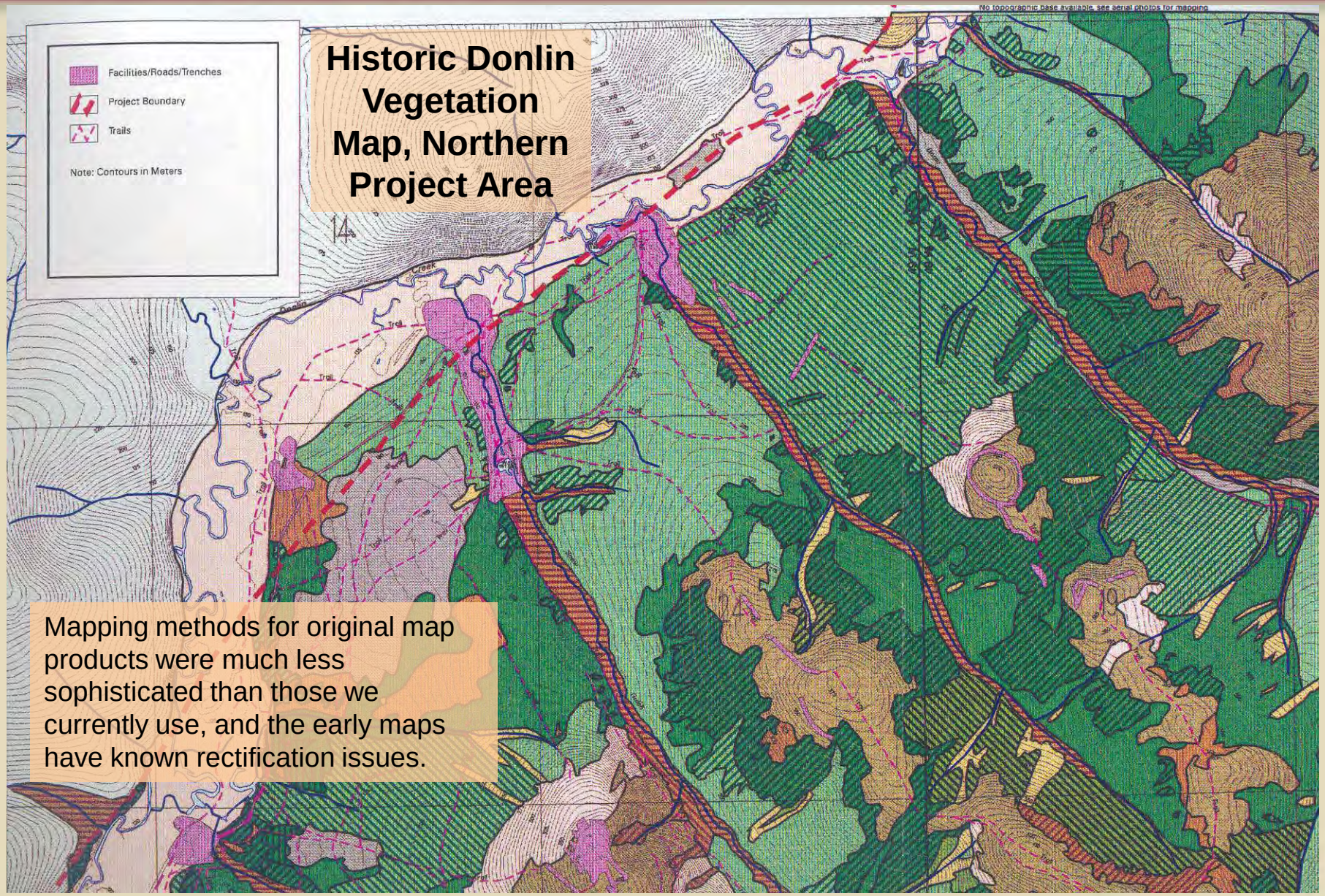

Historic Donlin Vegetation Map, Northern Project Area

Mapping methods for original map products were much less sophisticated than those we currently use, and the early maps have known rectification issues.

2003

- Placer Dome U.S./Technical Services resumes participation in the project.
- 3PP contracted to map the Anaconda Creek Watershed
- PDTS invests in high resolution ortho rectified photography of the proposed mine area
- ADOT flies multiple routes as part of their “Roads to Resources” initiative.

Upper Anaconda Creek

178 More Field Plots Added

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2004

No Additional Field Data Collected

- 3PP began the process of rectifying historical mapping/data to the new ortho-rectified photo base.
- Added new pre-mapping for the Anaconda and Upper American Creek Watersheds.
- Realized the volume of field data was becoming unmanageable and began working with to develop a data management solution.

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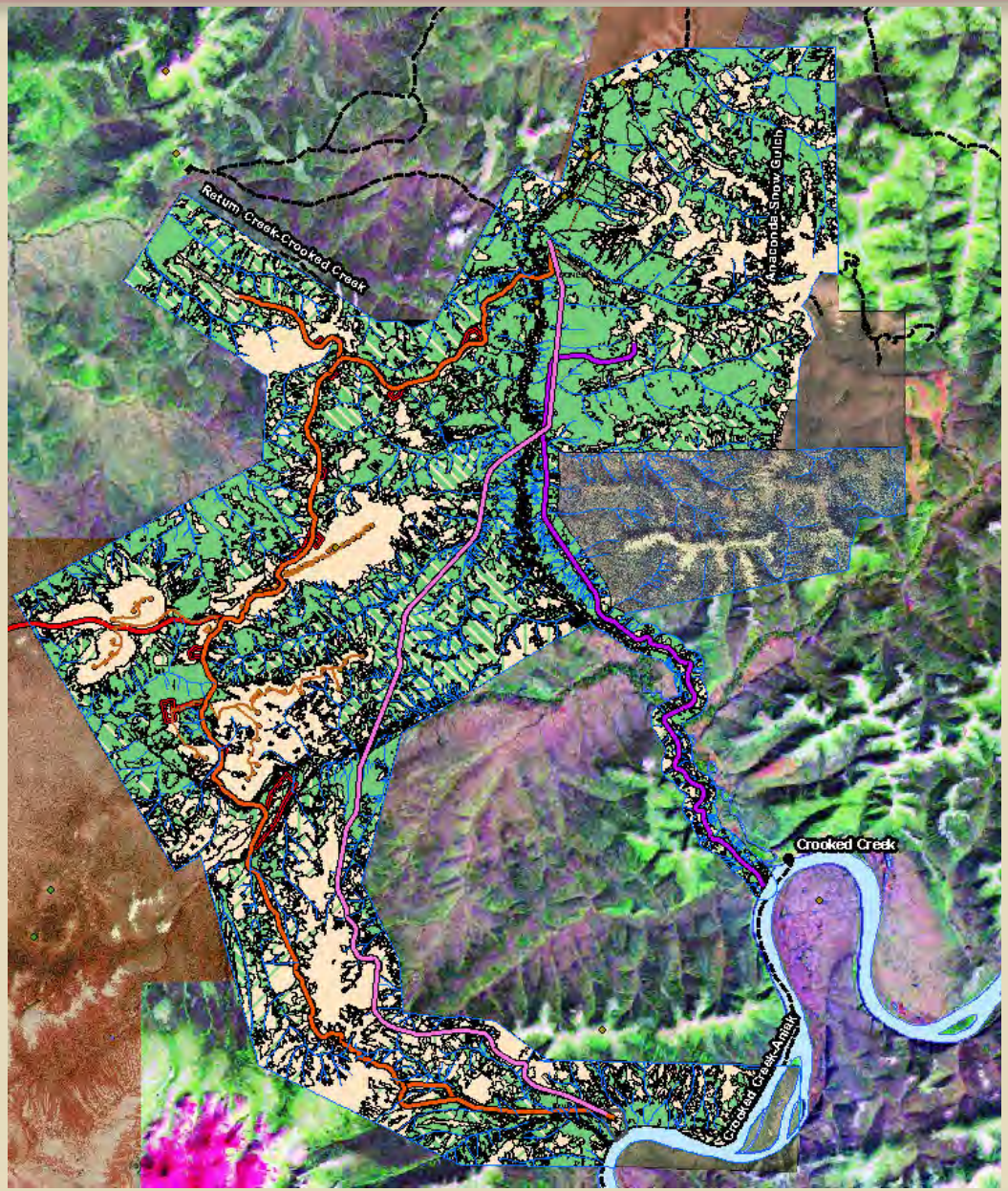
2005 - 2006

1,094 More Field Evaluations Completed

- An Access database was developed to better manage/QC Donlin project field data.
- We begin mapping the Jungjuk port site, access road and proposed wind farm.
- Logistical support/access problems preclude completion of all evaluations during the 2005 field season so worked extended into 2006.
- Magee Rapid Functional Assessment Method implemented to assess potential impacts from mine development in selected wetland systems around the project area.



Overview of Access Routes & Power Options Evaluated

2005-2006

Purple = Crooked Creek Alignment (ADOT)

Pink = East Upland Alignment (ADOT)

Orange = Jungjuk/Wind Farm Alignment (Rowland) Preferred Alternative

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2007 - 2009

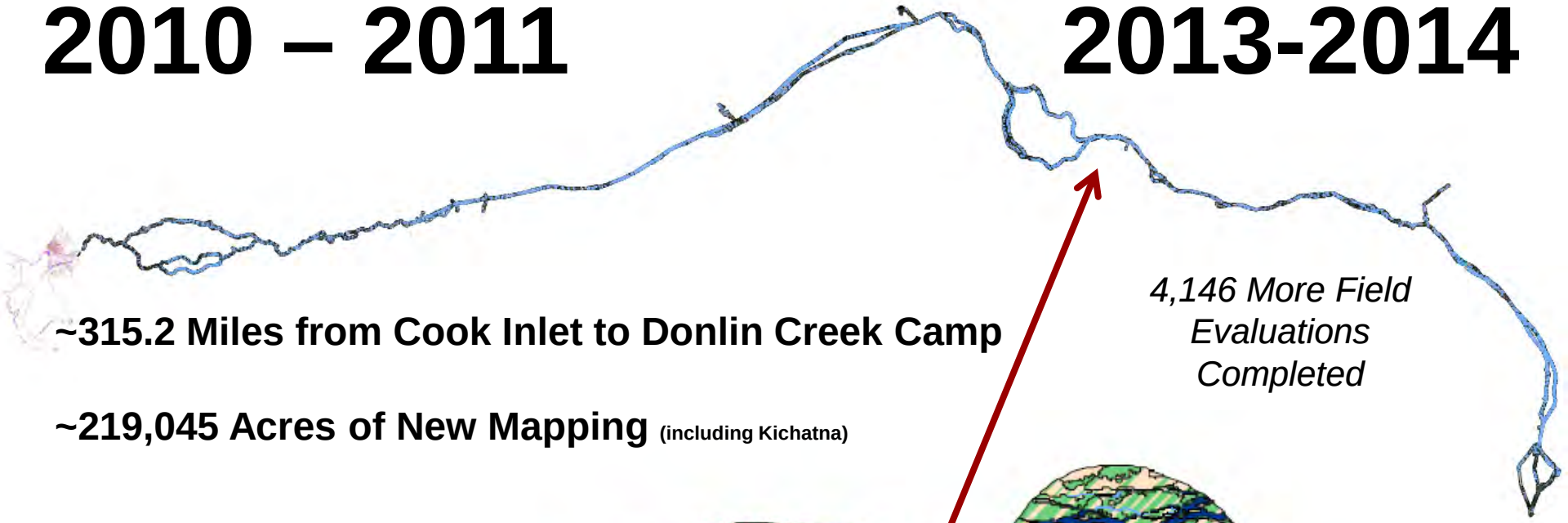
1,207 More Field Evaluations Completed

- The Donlin field data set maxes out the capabilities of our “new” Access database – so the 3PPI web based data management system, Smart Client Application (SCA), went into development.
- Field crews collect more data along the ADOT&PF Crooked Creek, East Upland & Birch Tree Crossing Road Alternatives, expanded wind farm & new material sites.

Digital mapping & analysis work continues…

2010 – 2011

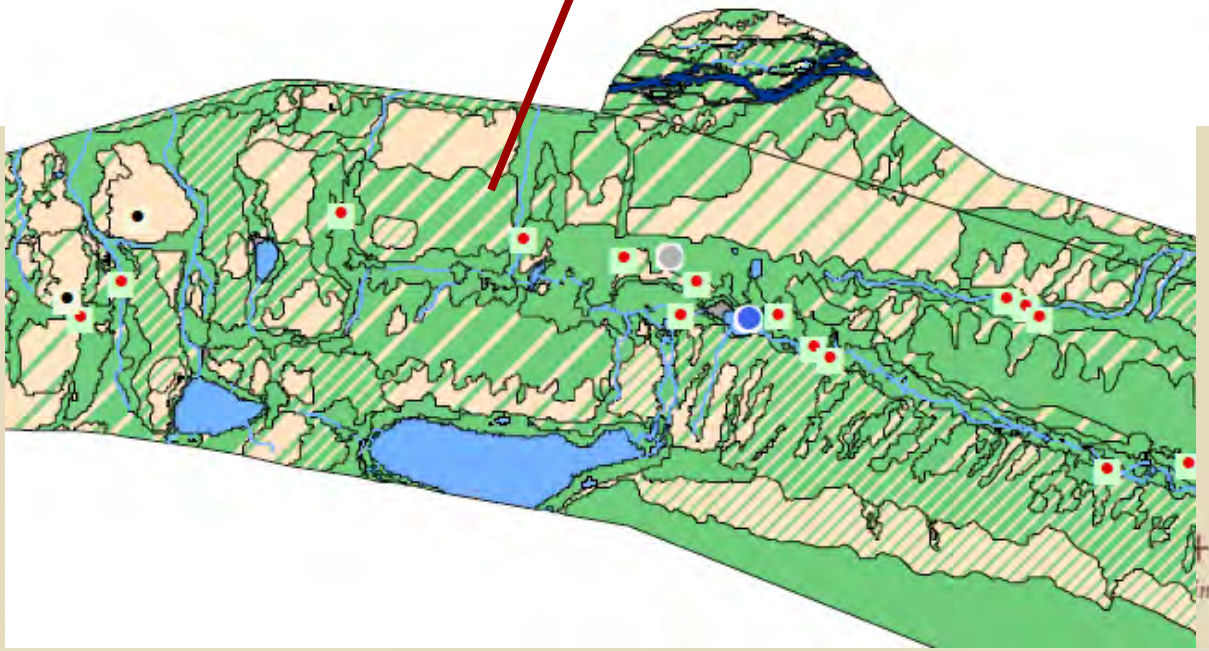
2013-2014



~315.2 Miles from Cook Inlet to Donlin Creek Camp

~219,045 Acres of New Mapping **(including Kichatna)**

4,146 More Field Evaluations Completed



PSA:
Natural Gas Pipeline Power Alternative

Current Plot Counts

Field Collected:	
Wetland Determinations	3,372
Functional Assessments	485
Waterbody, Stream Crossings	924
Representative Wetland Photos	838
Representative Upland Photos	1,280
Other Photo Points	109
Subtotal	*7,008*
Other:	
Extrapolated Functional Assessments	11,337
TOTAL DATA SET	**18,345**

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Pretty Creek Alignment, 2013

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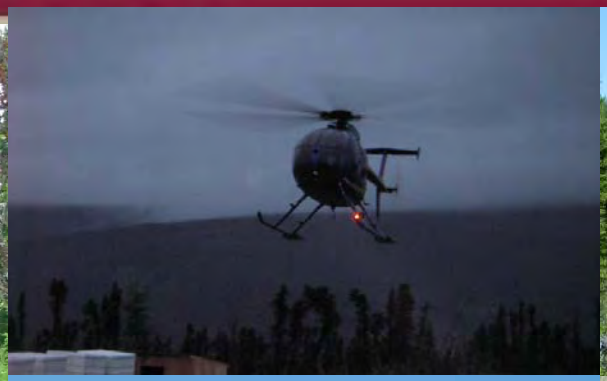
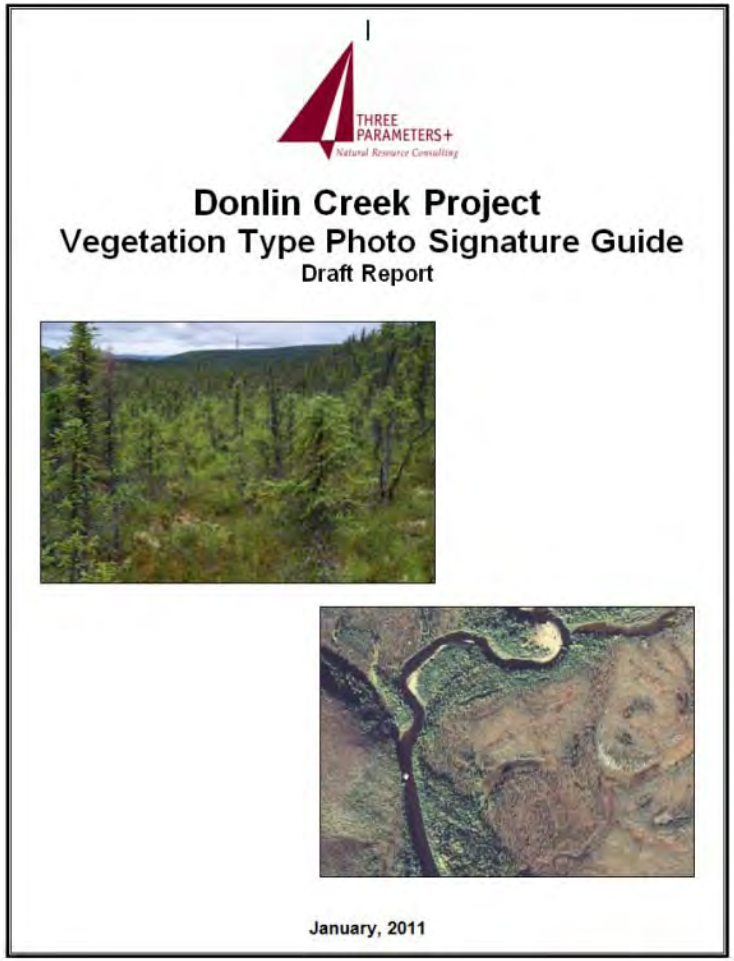







Digital Mapping



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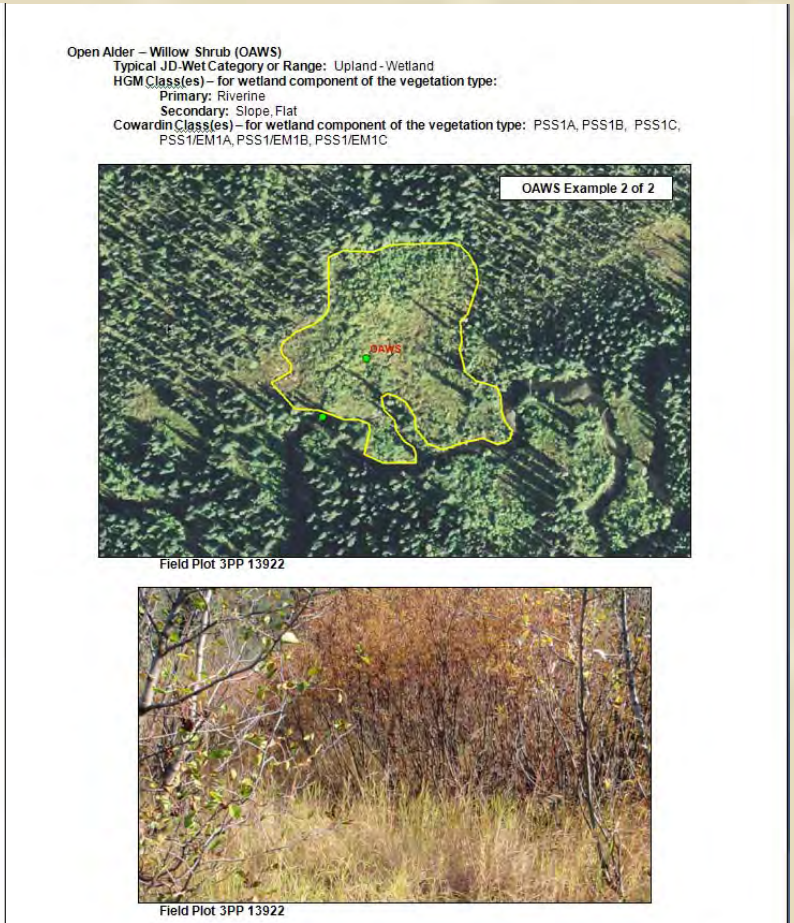
Donlin Creek Project
Vegetation Type Photo Signature Guide
Draft Report

January, 2011



Open Alder – Willow Shrub (OAWS)
Typical JD-Wet Category or Range: Upland - Wetland
HGM Class(es) – for wetland component of the vegetation type:
Primary: Riverine
Secondary: Slope, Flat
Cowardin Class(es) – for wetland component of the vegetation type: PSS1A, PSS1B, PSS1C, PSS1/EM1A, PSS1/EM1B, PSS1/EM1C

OAWS Example 2 of 2

Field Plot 3PP 13922

Field Plot 3PP 13922

Donlin Creek Project
Prepared for: Donlin Creek LLC
Prepared by: Three Parameters Plus, Inc.
Draft Vegetation Type Photo Signature Guide Version I

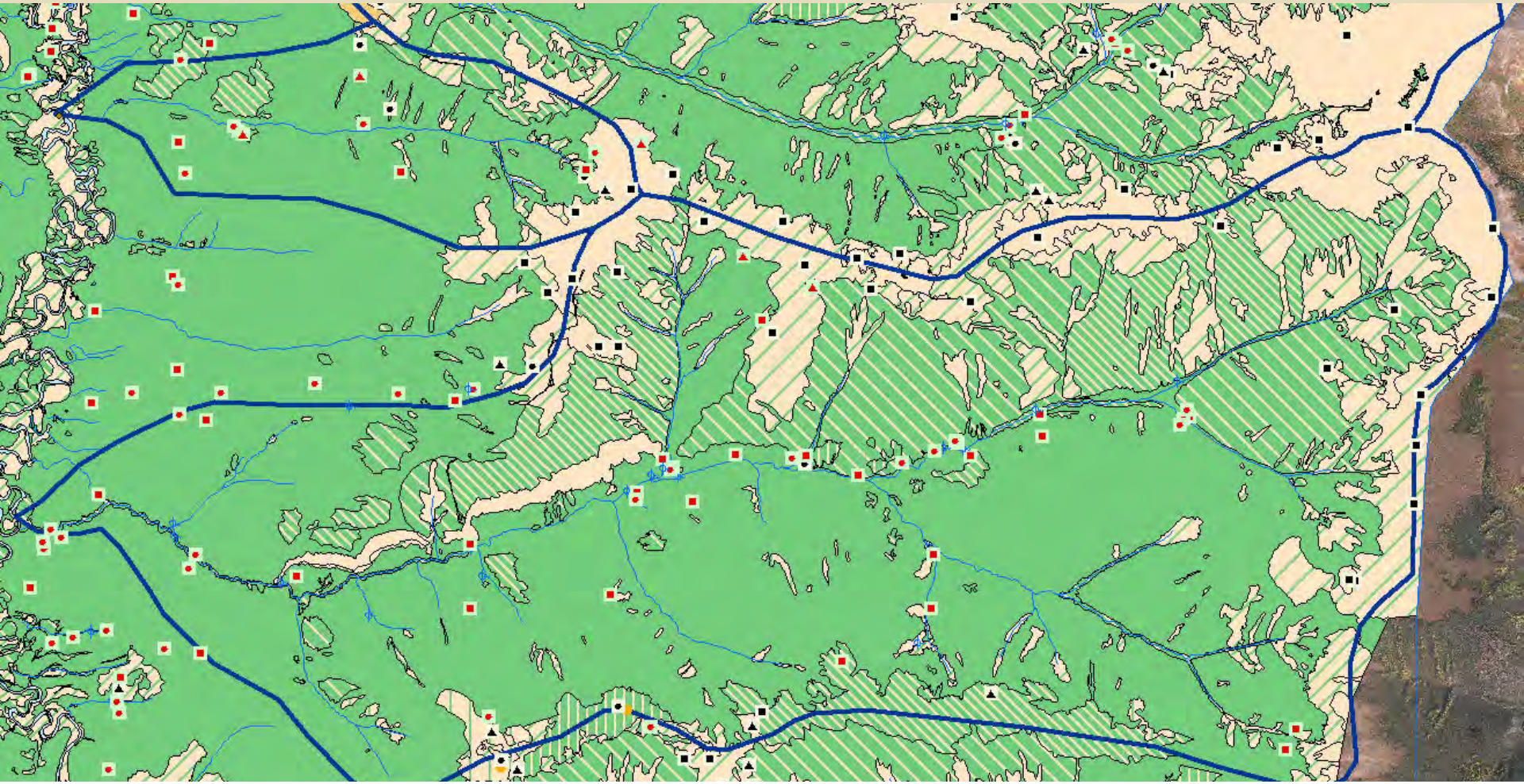
71

The most current version of this manual (version 15) includes 45 cover type descriptions

Anaconda Creek High Resolution Ortho Imagery

Anaconda Creek Uncoded Digital Mapping

Anaconda Creek Coded Digital Mapping



Shown: Jurisdictional Wetland Mapping for Anaconda Creek – Mosaic Mapping Units are Hatched. Green = Wetland

Each polygon has a JD Code, Vegetation type code, HGM classification, Cowardin Classification, and Disturbance code.

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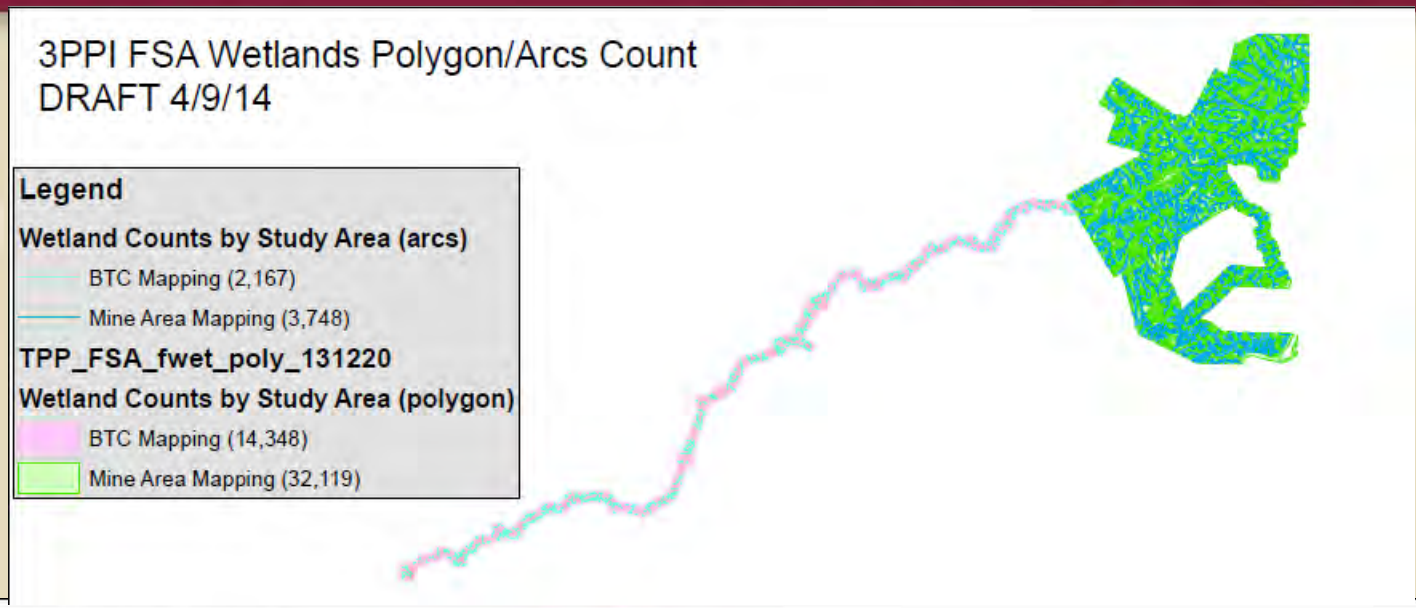
Combined Acres Mapped = 331,881.5

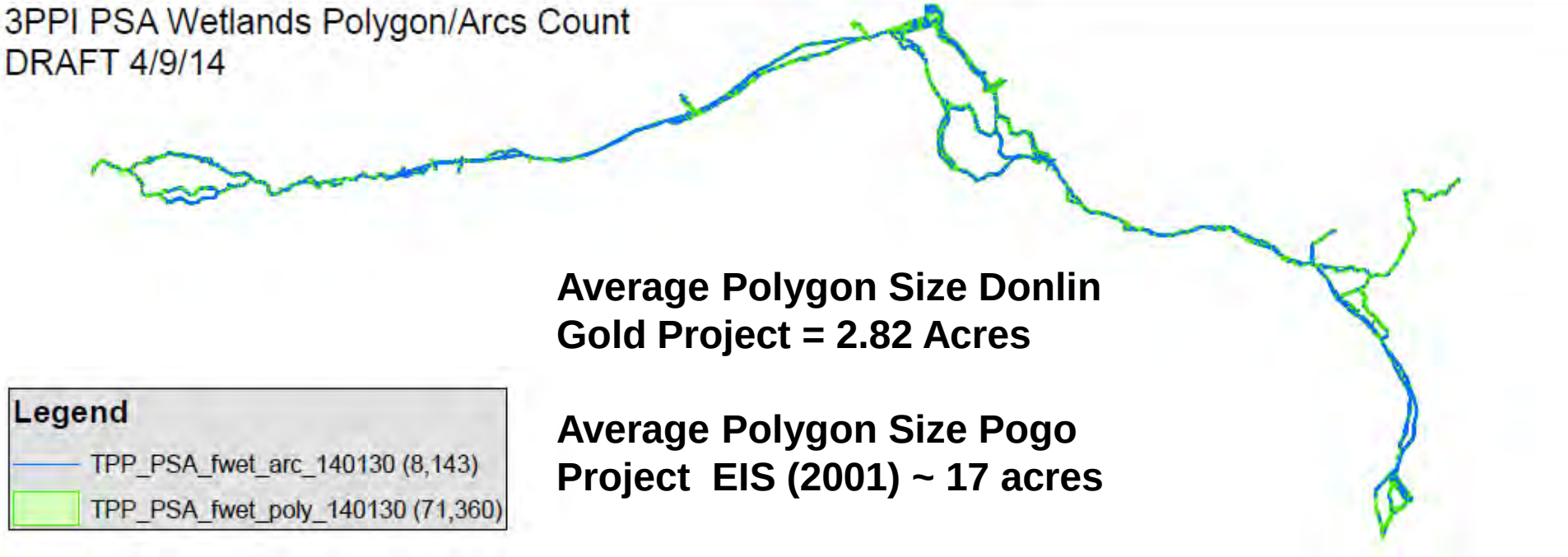
Combined Polygon Count = 117,827

(not including Kitchatna)

Combined Arc Count = 14,058

(not including Kitchatna)





Average Polygon Size Donlin Gold Project = 2.82 Acres

Average Polygon Size Pogo Project EIS (2001) ~ 17 acres

But Where Do We Go Now?

Now that we have lots of field data and a detailed map of wetland locations and cover types -- how do we use the data to prepare a quantitative functional assessment?

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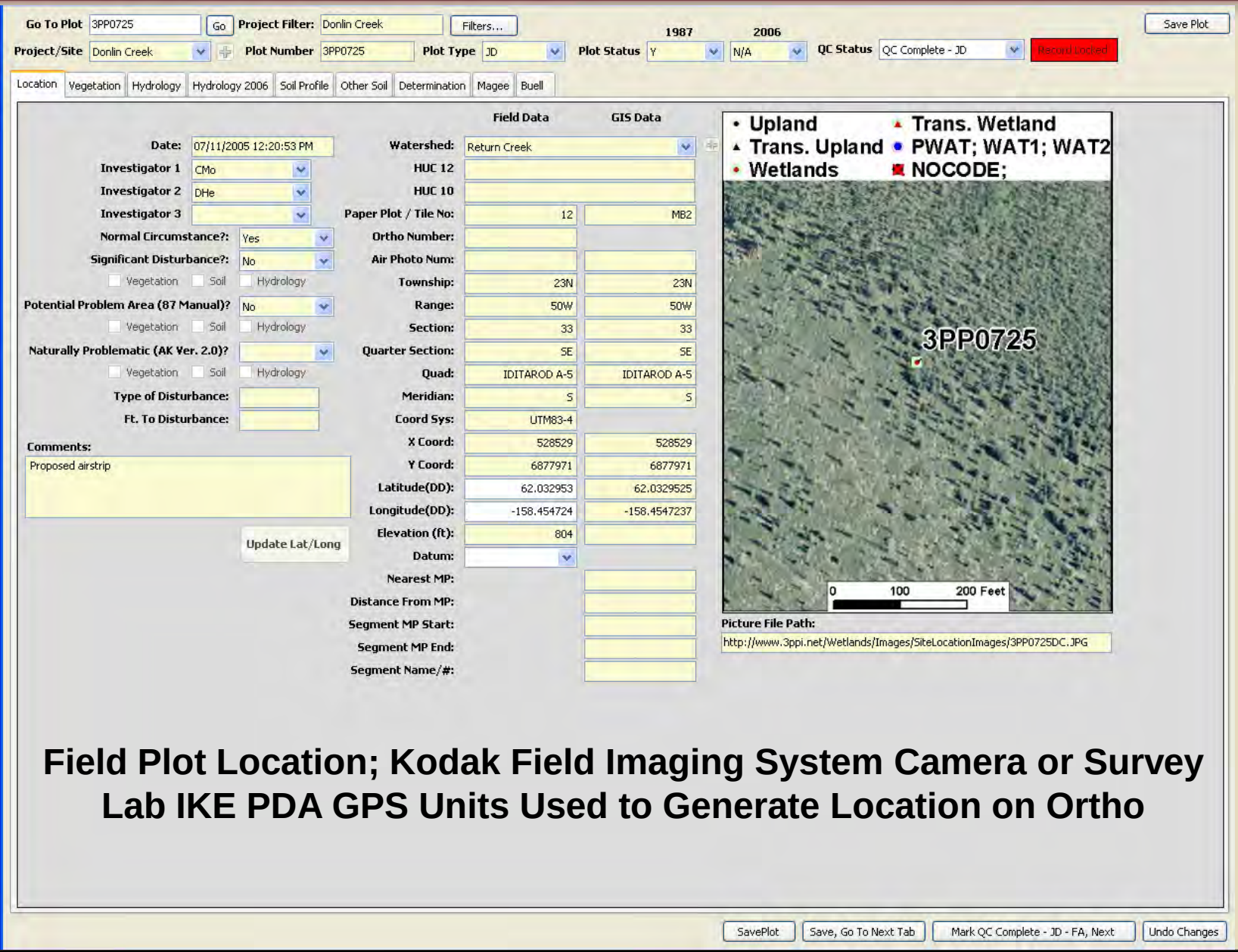

Field Plot Location; Kodak Field Imaging System Camera or Survey Lab IKE PDA GPS Units Used to Generate Location on Ortho

The SCA Database currently houses 7,008 field data points for the Donlin Gold Project Area & the 11,837 EFAs

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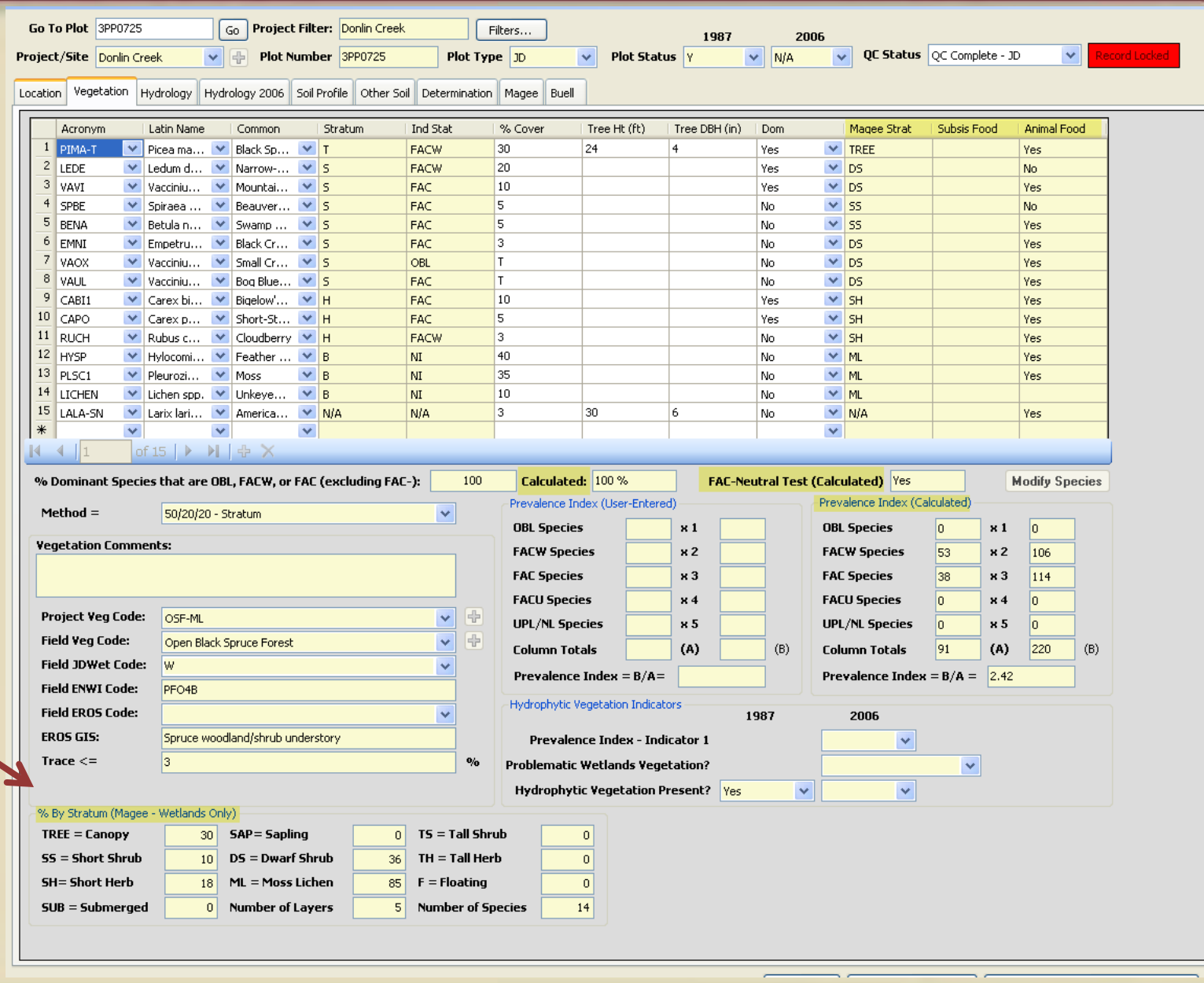
The Vegetation Page supports data QC through regional plant lists, 50/20 and Prevalence Indicator (PI) Calculations

It also supports the Functional Capacity Index (FCI) models used by the Magee FA Method



The database also provides a AK Regional Supplement "View" of the vegetation data (which is available online or as a PDF report)

Tree Stratum

Latin Name	Absolute % Cover	Dominant	Indicator
Picea mariana (Tree)	4	Yes	FACW
Larix laricina (Tree)	T	No	FACW
Populus tremuloides (Tree)	P	No	FACU

Total Cover: 4.00 %

50% of Total Cover: 2.00 % **20% of Total Cover:** 0.80 %

Sapling/Shrub Stratum

Latin Name	Absolute % Cover	Dominant	Indicator
Betula papyrifera s.l. (Sapling)	5	Yes	FACU
Empetrum nigrum	40	Yes	FAC
Ledum decumbens	20	Yes	FACW
Vaccinium uliginosum	12	No	FAC
Betula nana	10	No	FAC
Vaccinium vitis-idaea	5	No	FAC
Arctostaphylos alpina	4	No	FAC
Loiseleuria procumbens	3	No	NL
Salix glauca	T	No	FAC
Betula glandulosa	T	No	FAC

Total Cover: 99.00 %

50% of Total Cover: 49.50 % **20% of Total Cover:** 19.80 %

Herb Stratum

Latin Name	Absolute % Cover	Dominant	Indicator
Lycopodium annotinum	T	No	FAC

Total Cover: 0.00 %

50% of Total Cover: 0.00 % **20% of Total Cover:** 0.00 %

Plot Size (radius, or length x width): .1 Acre **% Bare Ground:** 0.00 %

% Cover of Wetland Bryophytes: **Total Cover of Bryophytes:** 45.00 %

** 3PPI field crews are rarely equipped to key bryophytes to species during field investigations*

Dominance Test:

Number of Dominant Species That Are OBL, FACW or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100 %	(A/B)

Prevalence Index:

	Total % Cover Of:		Multiply By:	
OBL Species	0	x 1 =	0	
FACW Species	24	x 2 =	48	
FAC Species	71	x 3 =	213	
FACU Species	5	x 4 =	20	
UPL Species	3	x 5 =	15	
Column Totals:	103	(A)	296	(B)

Prevalence Index B/A = 2.87

Hydrophytic Vegetation Indicators:

Yes	Dominance Test is >50%
Yes	Prevalence Index is <=3.0
	Morphological Adaptations (Supporting data provided in Remarks, below)
	Problematic Hydrophytic Vegetation

Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes

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Go To Plot 3PP0725 Go Project Filter: Donlin Creek Filters... Save Plot

Project/Site Donlin Creek Plot Number 3PP0725 Plot Type JD Plot Status 1987 Y 2006 N/A QC Status QC Complete - JD

Location | Vegetation | Hydrology | Hydrology 2006 | Soil Profile | Other Soil | Determination | Magee | Buell

Recorded Data (Describe in Remarks)
- Stream, Lake, or Tide Gauge
- Aerial Photographs (Years: 2005 , ,)
- Other
- No Recorded Data Available

Waterbody Type:
Water pH:
EC (Electrical Conductivity (uS/cm)):

Field Observations (inches):

Surface Water Present:		Depth of Surface Water:	
Water Table Present:		Depth to Water Table:	
Impeding Layer Present:		Depth to Impeding Layer:	14
Impeding Layer Type:	Dense Silt/Probably Permafrost?		
Saturated Soil Present:		Depth to Saturated Soil:	13
Depth to Free Water/Ice in	H2O:	Ice:	

1987 Wetland Hydrology Indicators

Primary Indicators		Secondary Indicators	
Inundated	No	Oxidized Root Channels	No
Saturated in Upper 12 inches	No	Water Stained Leaves	No
Water Marks	Yes	Local Soil Survey Data	N/A
Drift Lines	No	FAC-Neutral Test	Yes
Sediment Deposit	No	FAC-Neutral Calculated	Yes
Drainage Patterns in Wetlands	Yes	Other (explain in comments)	Yes

Aspect (degrees): 330 N
Percent Slope: 9 %
Elevation (ft.): 730
Landform: Hilltop
Macro-Topography: Flat
Micro-Topography: Hummocky (moderate)
HGM Class: Flat

Hydrology/Isolation Comments:

Other due to microtopography (D4). Saturation (Hydrology) is assumed with the Histic Epipedon call; notes indicate a dry year. Checked "other" under secondary to account for this (DHe 12/9/08).

Wetland Hydrology Present (1987 Manual)? Yes

1987 Hydrology Data Entry Screen

Go To Plot 3PP0725 Go Project Filter: Donlin Creek Filters...

Project/Site Donlin Creek Plot Number 3PP0725 Plot Type JD Plot Status 1987 Y 2006 N/A QC Status

Location | Vegetation | Hydrology | Hydrology 2006 | Soil Profile | Other Soil | Determination | Magee | Buell

AK Manual Indicators

	Surface Water (A1)
	High Water Table (A2)
	Saturation (A3)
	Water Marks (B1)
	Sediment Deposits (B2)
	Drift Deposits (B3)
No	Mat or Crust of Algae or Marl (B4)
No	Iron Deposits (B5)
No	Surface Soil Cracks (B6)
No	Inundation Visible on Aerial Imagery (B7)
	Sparsely Vegetated Concave Surface (B8)
	Hydrogen Sulfide Odor (C1)
Yes	Dry-Season Water Table (C2)
	Other (Explain Below)

AK Manual Secondary Indicators

	Water-Stained Leaves (B8)
	Drainage Patterns (B10)
	Oxidized Rhizospheres on Living Roots (C3)
	Presence of Reduced Iron (C4)
No	Salt Deposits (C5)
	Stunted or Stressed Plants (D1)
	Geomorphic Position (D2)
	Shallow Aquitard (D3)
Yes	Microtopographic Relief (D4)
Yes	FAC-Neutral Test (D5)
Yes	FAC-Neutral Test (Calculated)

Are climate/hydrologic conditions on the site typical for this time of year?

Climate Comments

Hydrology 2006 Comments

Wetland Hydrology Present (AK Manual)

AK Manual Hydrology Data Entry Screen

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Reports Administration

Go To Plot 3PP0725 Go Project Filter: Donlin Creek Filters... Save Plot

Project/Site Donlin Creek Plot Number 3PP0725 Plot Type JD Plot Status 1987 Y 2006 N/A QC Status QC Complete - JD Record Locked

Location | Vegetation | Hydrology | Hydrology 2006 | Soil Profile | Other Soil | Determination | Magee | Buell

Soil Survey Mapping Code: Field Taxonomy: Histic Cryaquepts 10 Edition Of Keys Used?

Soil Survey: Exploratory Soil Survey of Alaska Field Drainage Class: Poorly Drained Modify Soil Codes

(Series and Phase):

U/L DEPTH	Name	Matrix Color	%	Feature Type	%	Loc	Feature Color	Abund.	Size	Contrast	Coarse Frags	%	Mod	Texture	Struct.	Roots	pH	Fe+	mV
10 / 5	Oi															CVF,F,M,FC			
Order: 1																Comment:			
5 / 0	Oe															CVF,F,M,FC			
Order: 2																Comment:			
0 / 4	A1	7.5YR3/2	100											FSAL	SBK	CVF,F,FM	4.75	N	
Order: 3																Comment:			
4 / 6	Bx1	10YR5/1	40											SIL	MAS	FVF	5.0	N	
Order: 4		10YR4/1	60													Comment:			

Soil Profile Data Page

Go To Plot 3PP0725 Go Project Filter: Donlin Creek Filters... Save Plot

Project/Site Donlin Creek Plot Number 3PP0725 Plot Type JD Plot Status 1987 Y 2006 N/A QC Status

Location | Vegetation | Hydrology | Hydrology 2006 | Soil Profile | Other Soil | Determination | Magee | Buell

COE Manual Hydric Soils Indicators:

No	Histosol(16+")
Yes	Histic Epipedon(8-16")
No	Sulfidic Odor
No	Aquic Moisture Regime
No	Reducing Conditions
Yes	Gleyed or Low-Chroma Colors
No	High Organic Content Surface Layer Sandy Soils
No	Organic Streaking in Sandy Soils
N/A	Listed on Local Hydric Soils List
N/A	Listed on National Hydric Soils List
Yes	Hydric Per 1987 COE Manual?

Other Soil Remarks

Depth of Organic Mat(in):	10
Depth to Permafrost(in):	14
Major Rooting Zone:	14
Soil Temperature:	32 F
Soil Temperature Depth:	12
Cryoturbated:	No
Thixotropic:	No
Historic Soil pH:	

Soil Profile Comments:

NRCS-NTCHS

Hydric Per NRCS Field Taxonomic Class?: Yes

REFERENCE_ID	07 Code	06 Code	05 Code	04 Code	87 Code
2	A2 - Histic Epipedon	A2 - Histic Epipedon	A2 - Histic Epipedons	A2 - Histic Epipedons	B - Histic Epipedons

Soil Summary Data Page

Hydric Soils Present? 1987 Yes 2006

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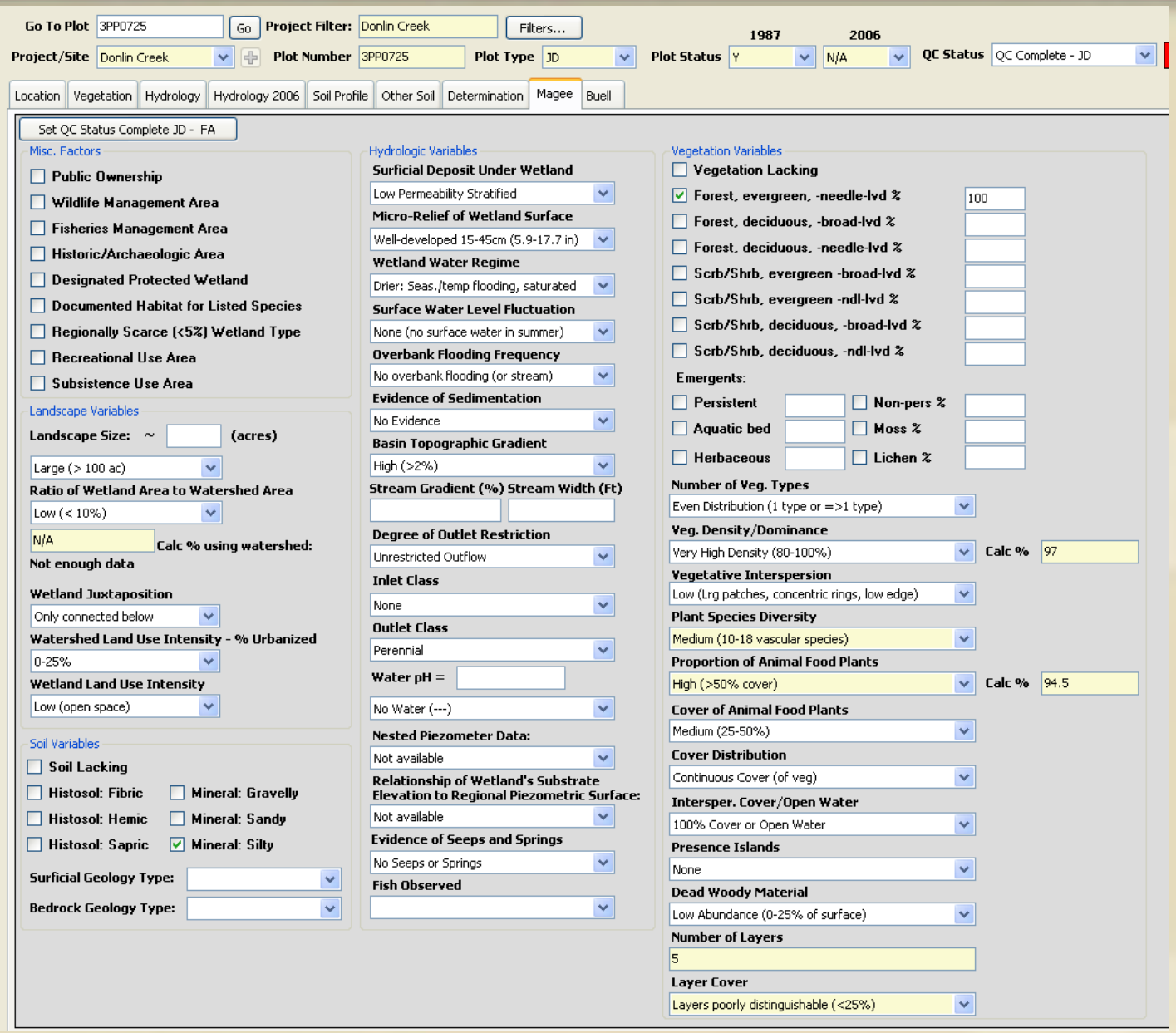

Magee Wetland Functional Assessment Method Data

As noted earlier, the Magee Models also use data stored on the Vegetation Page

Fields calculated by the database or populated from available GIS data have a yellow background. These are used as QC checks.

Functions	Definitions of Functions
Hydrology	
1. Modification of Groundwater Discharge (Model 1)	The capacity of the wetlands to influence the amount of water moving from groundwater to surface water.
2. Modification of Groundwater Recharge (Model 2)	The capacity of the wetlands to influence the amount of water moving from surface water to groundwater.
3. Storm and Floodwater Storage (Model 3)	The storage of inflowing water from storm events or flooding events, resulting in detention and retention of water on the wetland surface.
4. Modification of Stream Flow (Model 4)	The modification of inflow hydrology by the wetland to produce the outlet stream's hydrology.
5. Modification of Water Quality (Model 5)	Removal of suspended and dissolved solids from surface water, and dissolved solids from groundwater and conversion into other forms, plant or animal biomass, or gases.
Biogeochemistry	
6. Export of Detritus (Model 6)	Export of organic detritus from the wetland to adjacent and downstream aquatic systems.
Plant Community	
7. Contribution to Abundance and Diversity of Wetland Vegetation (Model 7)	The physical characteristics and ecological processes that maintain the characteristic plant species composition and abundance.
Faunal Habitat Support	
8. Contribution to Abundance and Diversity of Wetland Fauna (Model 8)	The capacity of a wetland to maintain a characteristic diversity and abundance of animal species that spend part or all of their life cycle in wetlands, individually, or as part of a mosaic of wetlands in a local landscape.

Note:

1.Source: Magee and Hollands 1998.

Magee evaluates 8 functions for 6 HGM Classes, 5 of which are found in the study area: Riverine, Slope, Depressional, Flat, and Lacustrine Fringe.

It does not produce FCIs for streams, rivers, lakes, ponds (i.e. waterbodies)

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FCIs Are Generated by the Database Using Mathematical Models

Variable Scores for the Function *Export of Detritus* at a Riverine Wetland in the Anaconda Creek Watershed (Plot 3PP1231a)

Variable (Variable Code)	Condition	Variable Score (Weight)
Wetland land use (Vwetuse)	low intensity	2
Wetland water regime (Vregm)	drier: seasonally flooded, temporarily flooded, saturated	3
Vegetation density/dominance (Vvegden)	very high	3
Soil type (Vsoil)	mineral hydric soil	3
Total variable score (a)		11
Maximum possible variable score (b)		12
Functional capacity index (FCI) score (a / b = FCI)		**0.92**

FCI = Functional Capacity Index (or Indices)

Example:

FCI = (Vwetuse + Vregm + Vvegden + Vsoil) / 12

Reports in the database allow us to QC the FCI results as needed on a plot by plot basis

Model	Model 1: Modification of Ground Water Discharge
Plot Number	3PP0722
HGM Class	Flat
Date	4/12/2014 6:58:04 AM

Variable	Condition	Weight	Value
Indicators of Disfunction			
Inlet/Outlet Class	Perennial inlet/no outlet	0	
Nested Piezometer Data	Recharge	0	
Relationship of Regional Piezometric Surface	Piez. surface above or at substrate elevation	0	
Direct Indicators of Function			
Evidence of Seeps & Springs	Seeps	18	
	Perennial spring	18	
Nested Piezometer Data	Discharge	18	
Relationship of Regional Piezometric Surface	Piez. surface below substrate elevation	18	
Inlet/Outlet Class	No inlet/perennial outlet	18	
Primary Variables			
Microrelief of Wetland Surface	Pronounced >45 cm	3	
	Well Developed 15-45 cm	2	2.0000000000000
	Poorly Developed 15 cm	1	
	Absent	0	
Inlet/Outlet Class	Perennial inlet/perennial outlet	3	
	Intermittent inlet/perennial outlet	2	
	No inlet/no outlet	0	0.0000000000000
	No inlet/intermittent outlet	0	
	Intermittent inlet/no outlet	0	
	Intermittent inlet/intermittent outlet	0	
	Perennial inlet/no outlet	0	
Water pH	Alkaline (>7.4)	3	
	Circumneutral (5.5-7.4)	2	
	Acid (<5.5)	0	
	No water	0	0.0000000000000
Surficial Deposit Under Wetland	High Permeability Stratified	3	
	Low Permeability Stratified	2	2.0000000000000
	Glacial Till	1	
Wetland Water Regime	Wet: Perm flooded, intermittantly exposed, semiperm flooded	3	
	Dry: Seasonally flooded, temporarily flooded, saturated	1	1.0000000000000
Soil Variables	Histosol: Fibric	3	
	Histosol: Hemic	3	
	Histosol: Sapric	3	

Magee Method Scoring System Converted to Formula Expressions

Functions	Magee and Hollands 1998 Functional Capacity Index Formula
Hydrology	
1. Modification of Groundwater Discharge	FCI = (Vmicro + Vinout + VpH + Vsurgeo + Vregm + Vsoil) / 18 for depressional and flat wetlands. FCI = (Vmicro + Vinout + VpH + Vsurgeo + Vsoil) / 15 for slope wetlands. FCI = (Vmicro + VpH + Vsurgeo + Vregm + Vsoil) / 15 for riverine wetlands.
2. Modification of Groundwater Recharge	FCI = (Vmicro + VpH + Vsurgeo + Vsurwat + Vregm + Vsoil) / 18 for lacustrine fringe and riverine wetlands. FCI = (Vmicro + Vinout + VpH + Vsurgeo + Vsurwat + Vregm + Vsoil) / 21 for depressional and flat wetlands.
3. Storm and Floodwater Storage	FCI = (Vinout + Vout + Vtopo + Vmicro + Vfreq + Vvegden + Vsurwat + Varea + Vregm + Vwood) / 30 for flat wetlands FCI = (Vtopo + Vmicro + Vfreq + Vvegden + Vsurwat + Varea + Vregm + Vwood) /24 for riverine wetlands. FCI = (Vmicro + Vfreq + Vvegden + Vsurwat + Varea + Vregm + Vwood) / 21 for lacustrine fringe wetlands. FCI = (Vinout + Vtopo + Vmicro + Vvegden + Varea + Vregm + Vwood) / 21 for slope wetlands. FCI = (Vinout + Vout + Vtopo + Vmicro + Vvegden + Vsurwat + Varea + Vregm + Vwood) / 27 for depressional wetlands.
4. Modification of Stream Flow	FCI = (Storm and Floodwater Storage x Modification of Groundwater Discharge).
5. Modification of Water Quality	FCI = (Vwetuse + Vout + Vinout + Vtype + Vcover + Vsoil) / 18 for depressional and flat wetlands. FCI = (Vwetuse + Vinout + Vtype + Vcover + Vsoil) / 15 for slope wetlands. FCI = (Vwetuse + Vtype + Vcover + Vsoil) / 12 for lacustrine fringe and riverine wetlands.
Biogeochemistry	
6. Export of Detritus	FCI = (Vwetuse + Vout + Vinout + Vregm + Vvegden + Vsoil) / 18 for depressional and flat wetlands. FCI = (Vwetuse + Vinout + Vregm + Vvegden + Vsoil) / 15 for slope wetlands. FCI = (Vwetuse + Vregm + Vvegden + Vsoil) / 12 for lacustrine fringe and riverine wetlands.
Plant Community	
7. Contribution to Abundance and Diversity of Wetland Vegetation	FCI = (Vdivers + Vvegden + Vjuxta) / 15 for all HGM classes.
Faunal Habitat Support	
8. Contribution to Abundance and Diversity of Wetland Fauna	FCI = (Vsheduse + Vwetuse + Vregm + Vmicro + Vnum + Vprop + Vintrspr + Vlayers + Vlayers2 + Vopenwat + Vsize + Vjuxta) / 36 for depressional, lacustrine fringe, riverine, and flat wetlands. FCI = (Vsheduse + Vwetuse + Vregm + Vmicro + Vnum + Vprop + Vintrspr + Vlayers + Vlayers2 + Vsize + Vjuxta) / 33 for slope wetlands.

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Go To Plot: 3PP0725 [Go] Project Filter: Donlin Creek [Filters...] [Save Plot]

Project/Site: Donlin Creek Plot Number: 3PP0725 Plot Type: JD Plot Status: 1987 Y / 2006 N/A QC Status: QC Complete - JD [Record Locked]

Location | Vegetation | Hydrology | Hydrology 2006 | Soil Profile | Other Soil | Determination | Magee | Buell

	1987	2006
Hydrophytic Vegetation Present?	Yes	
Wetland Hydrology Present?	Yes	
Hydric Soils Present?	Yes	
Plot Meets Wetland Criteria?	Y	N/A

Date: 07/11/2005 12:20:53 PM Bearing: N/A

Subject: Soils APS Roll Number:

Picture File Path:

http://www.3ppi.net/Wetlands/Images/FieldImages/DC_20050720_06/3pp-7/P000

Field Image Comments

Other Remarks

Wildlife Observation Remarks

Ptarmagin scat

Engineering Concerns

None

Wildlife Observations and Signs

	Animal	Sign	Observation
▶	Other	☑	☐
*		☐	☐

Other Comments

Sign: Ptarmigan

Obs.:

Model Summary

HGM Class: Flat	Score	FCI
Model 1: Modification of Ground Water Discharge	18	1.00
Model 2: Modification of Ground Water Recharge	0	0.00
Model 3: Storm and Flood-Water Storage	12	0.40
Model 4: Modification of Stream Flow	6	0.67
Model 5: Modification of Water Quality	13	0.72
Model 6: Export of Detritus	17	0.94
Model 7: Contribution to Abundance and Diversity of Wetland Vegetation	11	0.73
Model 8: Contribution to Abundance and Diversity of Wetland Fauna	26	0.72
Average FCI	0.65	

[Refresh Model]

Determination Page Allows Users to View All Photos Associated With the Data Point

Three Parameters Plus, Inc.
3PP Wetlands SmartClient Application

The shapefile generator allows us to get the data from the DB into the spatial environment

Shapefile Generator

Project Name: Donlin Creek | Clear

To build the GIS FCI layer, these attributes are used.

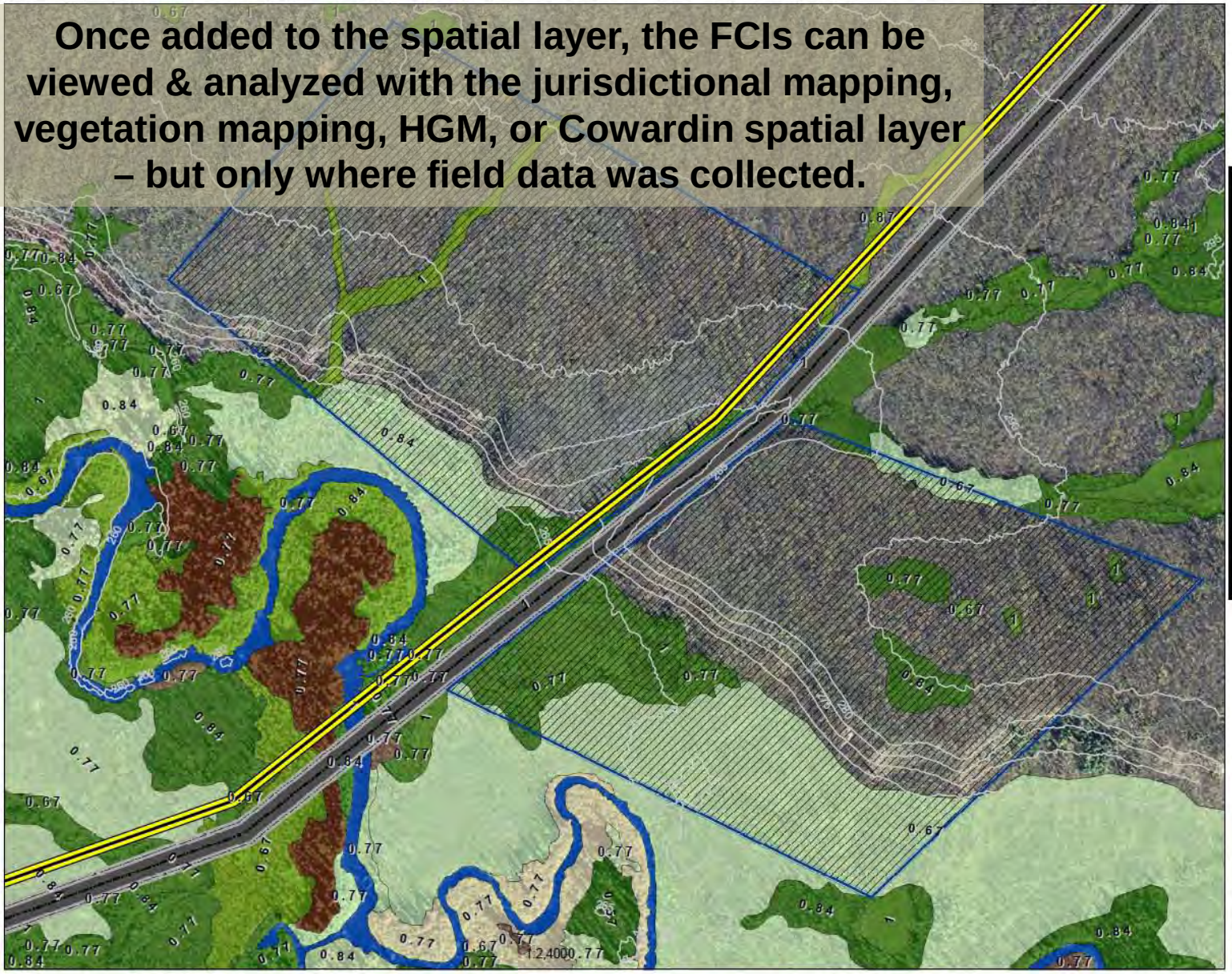
Hydrology:	Landscape:	Other Soil:	Determination:	Misc:
<All>	<All>	<All>	<All>	<All>
Depth of Surface Water	Aspect	Depth of Organic Mat	Average FCI	date_ast
Depth of Water Table	Elevation	Depth to Permafrost	FCI1	eros_gis
Depth Saturated Soil	Landform	Field Taxonomy	FCI2	invest12
EC	Macro Topography	Major Rooting Zone	FCI3	nwi_new
Stream Width	Micro Topography	Soil Temperature	FCI4	nwi_old
Water pH	Percent Slope		FCI5	Quadrant
Waterbody Type			FCI6	rng
			FCI7	sec
			FCI8	secq
				twn
				X
				Y
Clear	Clear	Clear	Clear	Clear

Auto Included Fields: Project Name, Plot Number, Plot Date, Plot Type, QC Status, Principal Investigator, JD Wet Code, JD Wet Code AK Manual, Project Vegetation, HGM Code, ENWI Code, Coordinate System, Latitude, Longitude, jdwet_stat, Degree Outlet Restriction, Inlet Class, Outlet Class, Watershed

Generate Shape File

Download

Once added to the spatial layer, the FCIs can be viewed & analyzed with the jurisdictional mapping, vegetation mapping, HGM, or Cowardin spatial layer – but only where field data was collected.



7,008 field data points; of these 2,368 contributing data needed to produce FCIs

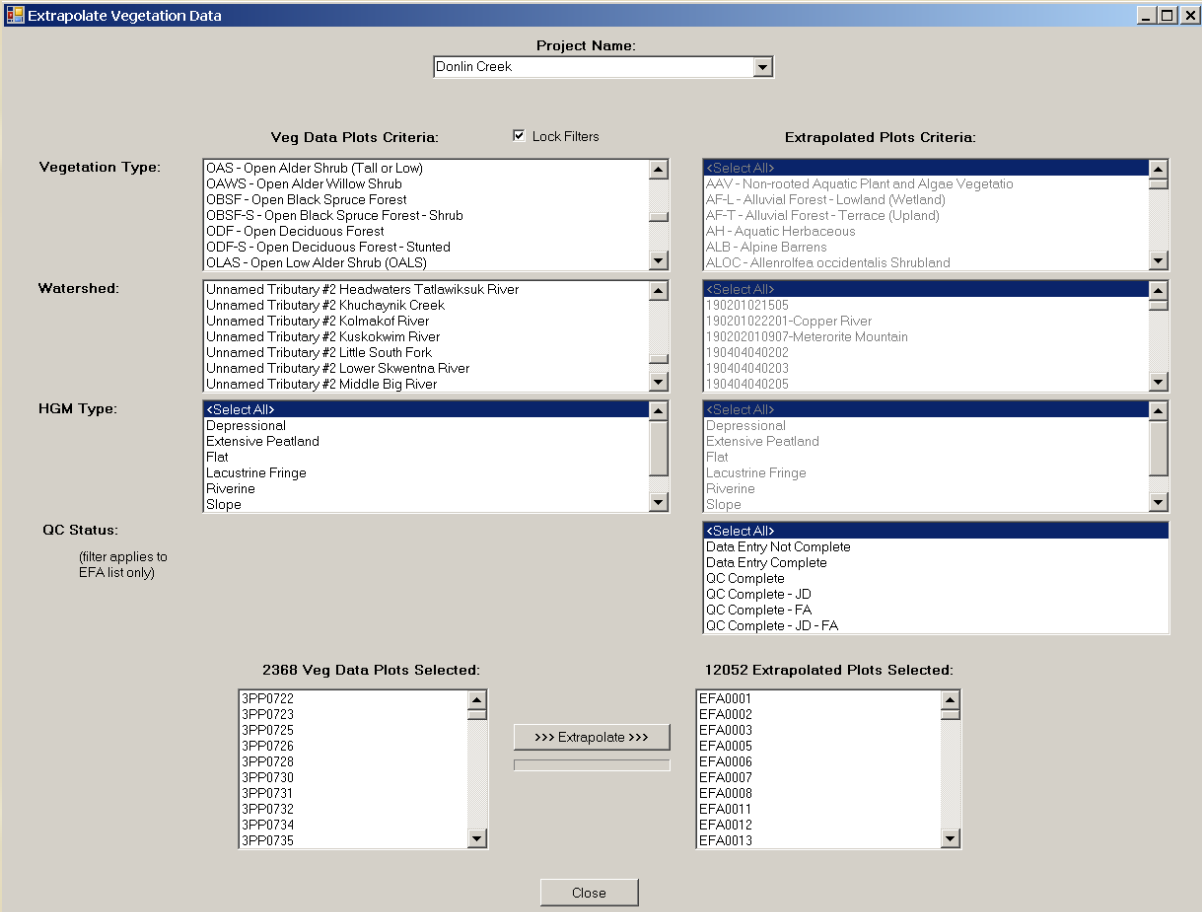
117,827 polygons in the FA study area…

How do we rate the other 115,459 polygons?

First we evaluate polygons under proposed impact areas

3PPI Plot Type = EFA

EFA = Extrapolated Functional Assessment



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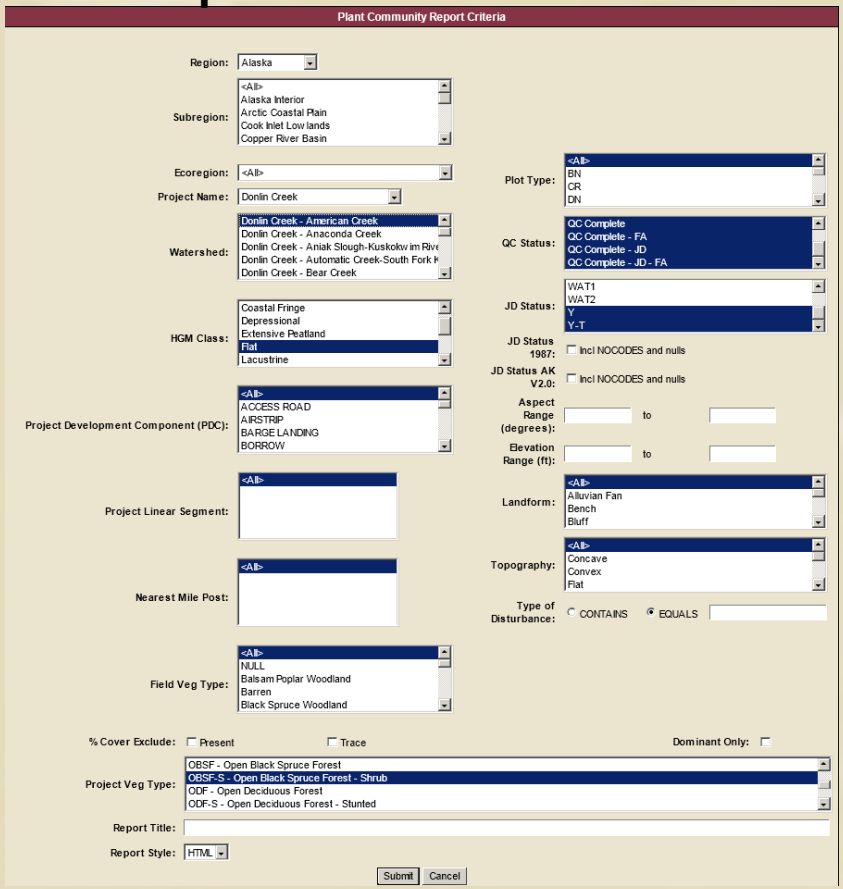
Polygons that intersect with known facilities (i.e. impact areas) are evaluated with EFAs.

Dark Green = Field FAs

Light Green = Extrapolated FAs

Filters set in the EFA tool extract the same compiled vegetation data a plant community report would generate for the same HGM/Veg Type and inserts the averages into the EFA plots.



Species Composition:

Trees:

Latin Name	Common Name	Ind. Status	% Cov. Range	% Avg.	% Std. Dev.	Freq.	Avg. Height (Ft)	Avg. DBH (in)
Betula papyrifera s.l. (Tree)	Paper Birch (Trees)	FACU	1.5-4	2.8	1.8	2	20.0	3.8
Larix laricina (Tree)	American Larch (Trees)	FACW	1.5-10	3.9	3.0	14	22.7	4.3
Picea glauca (Tree)	White Spruce (Trees)	FACU	5-5	5.0	0	2	0.0	0.0
Picea mariana (Tree)	Black Spruce (Trees)	FACW	1.5-55	19.2	12.8	28	22.8	3.9

Saplings:

Latin Name	Common Name	Ind. Status	% Cov. Range	% Avg.	% Std. Dev.	Freq.	JD C Ra
Betula papyrifera s.l. (Sapling)	Paper Birch (Saplings)	FACU	3-3	3.0	0	1	0-3
Larix laricina (Sapling)	American Larch (Saplings)	FACW	1.5-10	4.1	3.0	7	0-1(
Picea mariana (Sapling)	Black Spruce (saplings)	FACW	7-45	25.7	11.4	16	0-45

Shrubs:

Latin Name	Common Name	Ind. Status	% Cov. Range	% Avg.	% Std. Dev.	Freq.	JD C Ra
Alnus crispa	Green Alder (Shrub)	FAC	1.5-35	9.0	9.6	11	0-35
Alnus spp.	Unkeyed Alder	FAC	20-30	25.0	7.1	2	0-30
Andromeda polifolia	Bog Rosemary	OBL	1.5-1.5	1.5	0	2	0-1.
Arctostaphylos alpina	Alpine Manzanita	FAC	1.5-1.5	1.5	0	1	0-1.
Arctostaphylos uva-ursi	Bearberry	UPL	1.5-1.5	1.5	0	1	0-1.
Betula glandulosa	Tundra Dw arf Birch	FAC	8-30	19.0	15.6	2	0-30
Betula nana	Sw amp Birch	FAC	1.5-25	13.0	6.9	23	0-25
Chamaedaphne calyculata	Leatherleaf	FACW	4-5	4.5	0.7	2	0-5
Empetrum nigrum	Black Crow berry	FAC	5-40	14.4	7.4	33	5-40
Ledum decumbens	Narrow -Leaf Labrador-Tea	FACW	5-65	24.9	17.6	18	0-65
Ledum groenlandicum	Bog Labrador-Tea	FACW	1.5-15	9.1	6.9	4	0-15
Ledum spp.	Labrador Tea	FACW	15-45	24.6	8.8	13	0-45
Salix pulchra	Diamond-Leaf Willow	FACW	5-8	6.5	2.1	2	0-8
Spiraea beauverdiana	Beauverd Spiraea	FAC	1.5-20	7.2	6.1	8	0-20
Vaccinium microcarpus	Blueberry	OBL	5-30	16.9	8.0	8	0-30
Vaccinium ovalifolium	Early Blueberry	FAC	15-15	15.0	0	1	0-15
Vaccinium oxycoccos	Small Cranberry	OBL	1.5-15	4.5	3.8	17	0-15
Vaccinium uliginosum	Bog Blueberry	FAC	1.5-30	14.2	6.9	20	0-30
Vaccinium vitis-idaea	Mountain Cranberry	FAC	1.5-25	10.7	6.6	29	0-25

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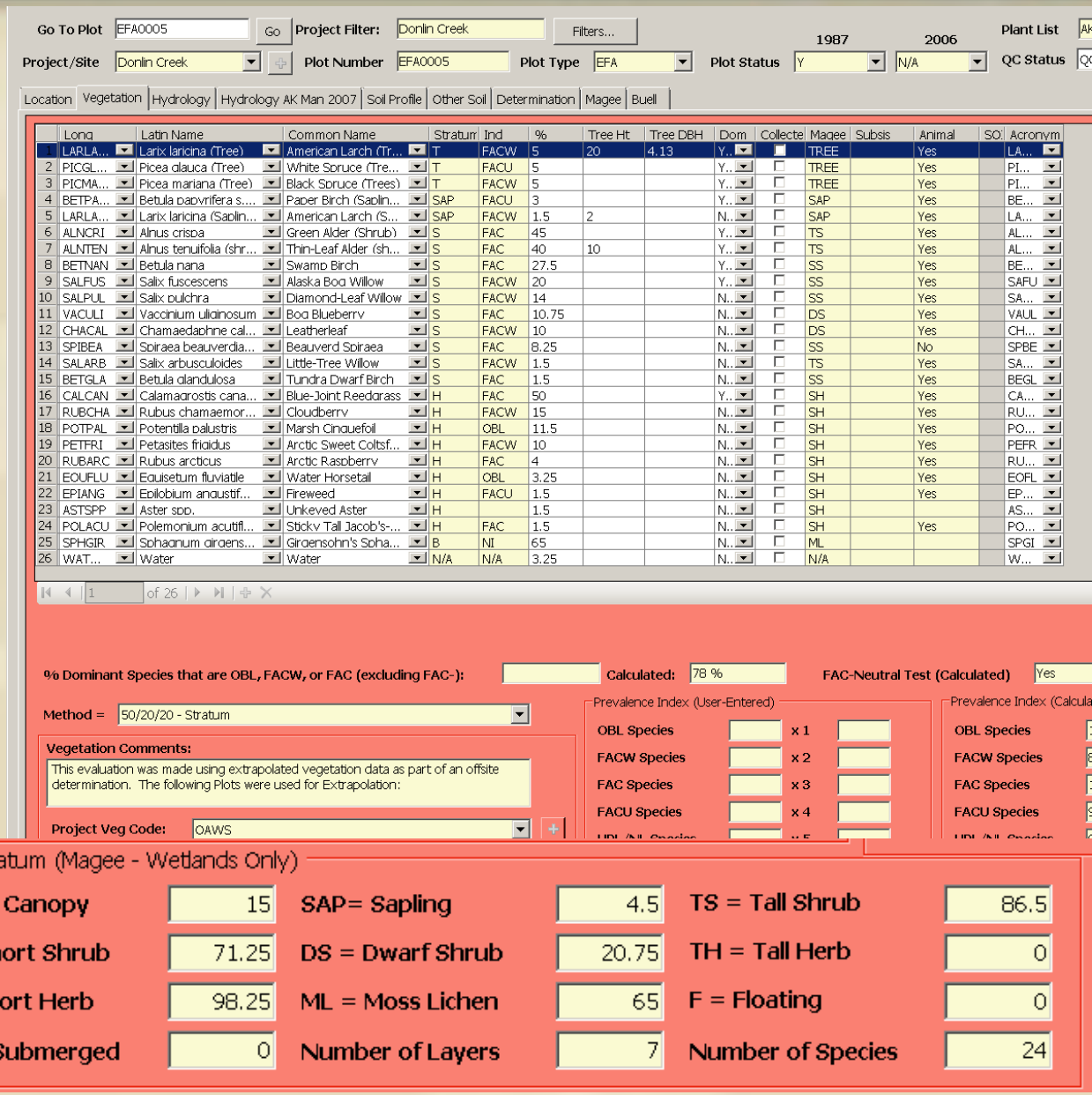
Extrapolated vegetation data appear with a red background in the database to alert users the data are extrapolated (not site specific field collected data).

3PPI technical staff then manually populate the other fields in each EFA plot needed to generated the FCIs. To do this they use GIS layers, aerial photography, and best professional judgment.

Magee stratum values used by the models are calculated automatically.



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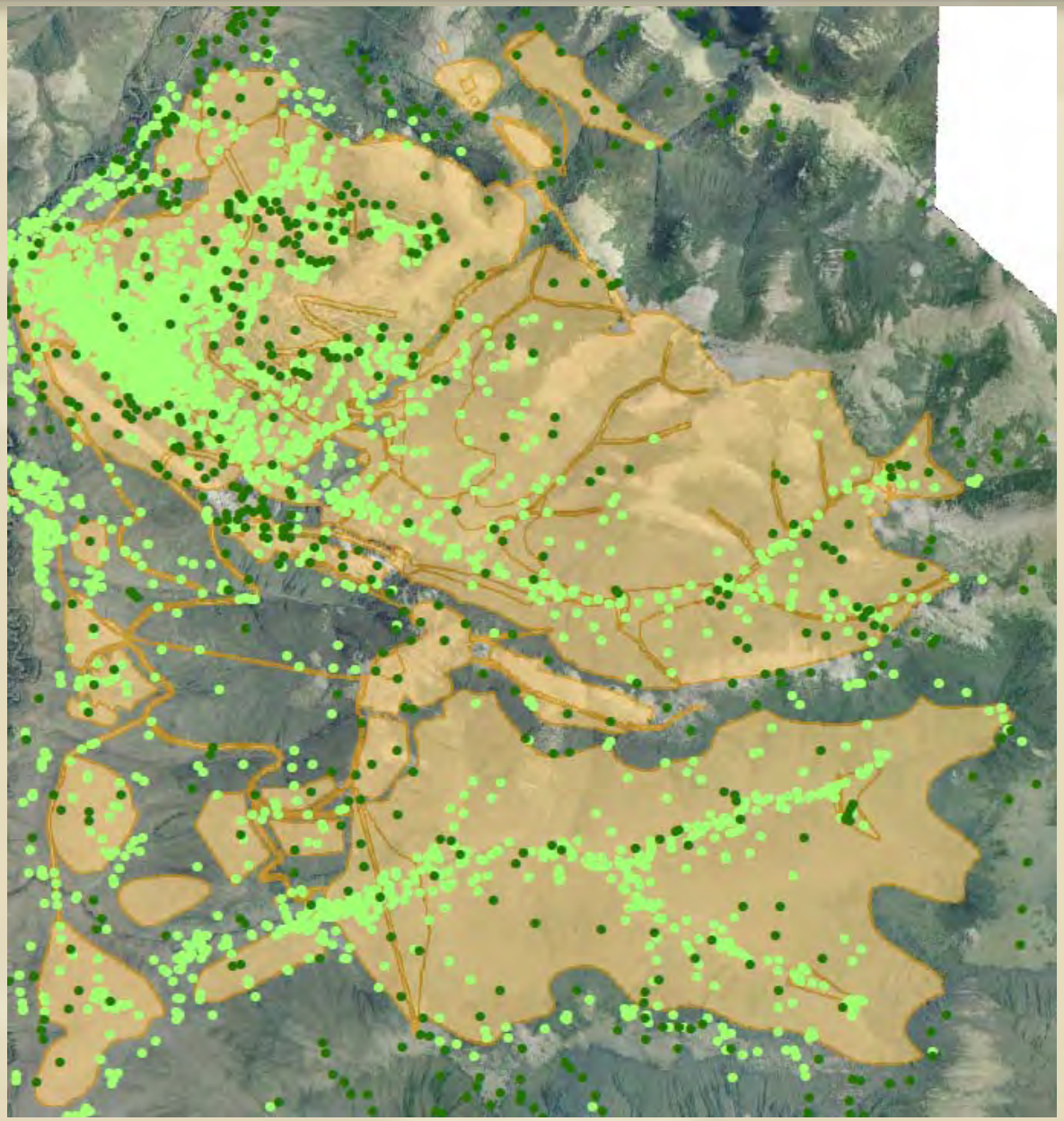
So… now we have FCIs for each polygon where we have field data and/or are expecting project impacts…

But what about the rest of the area?

How were FCI's generated there?



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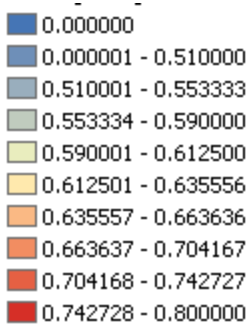
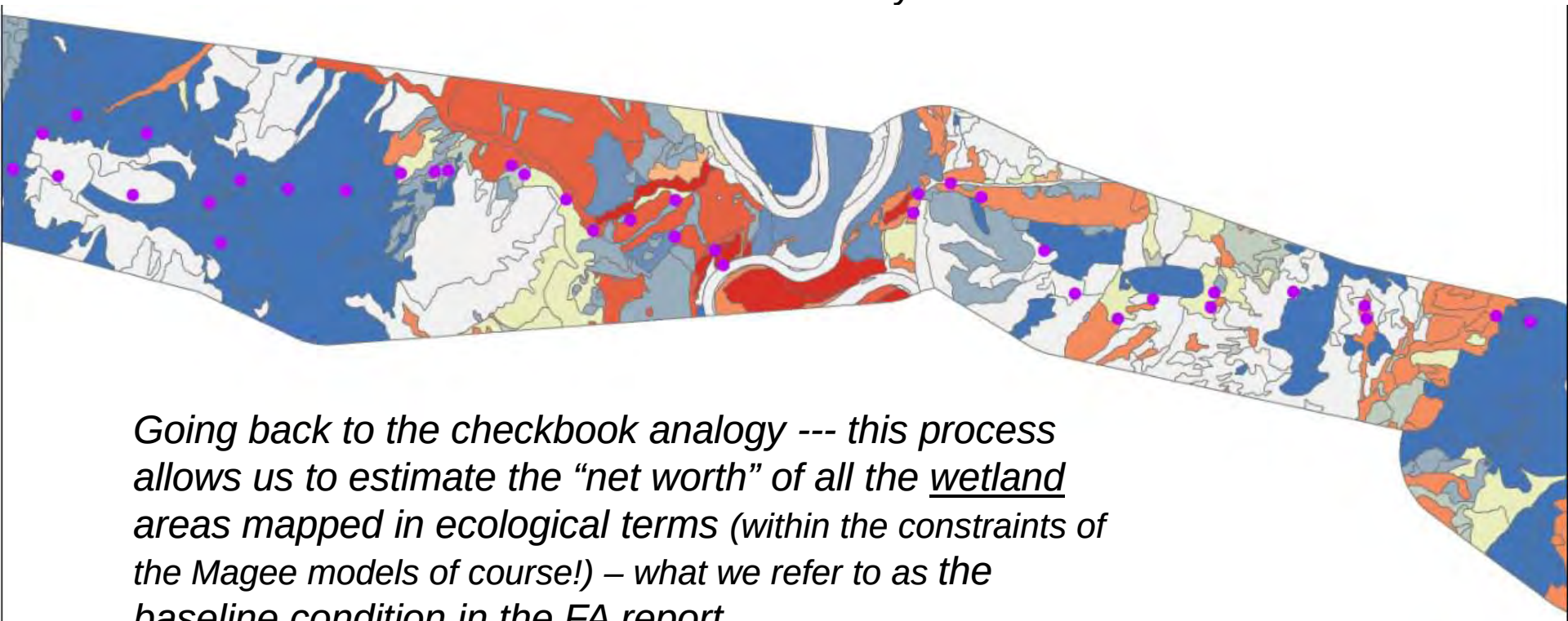
Extrapolating The Extrapolated



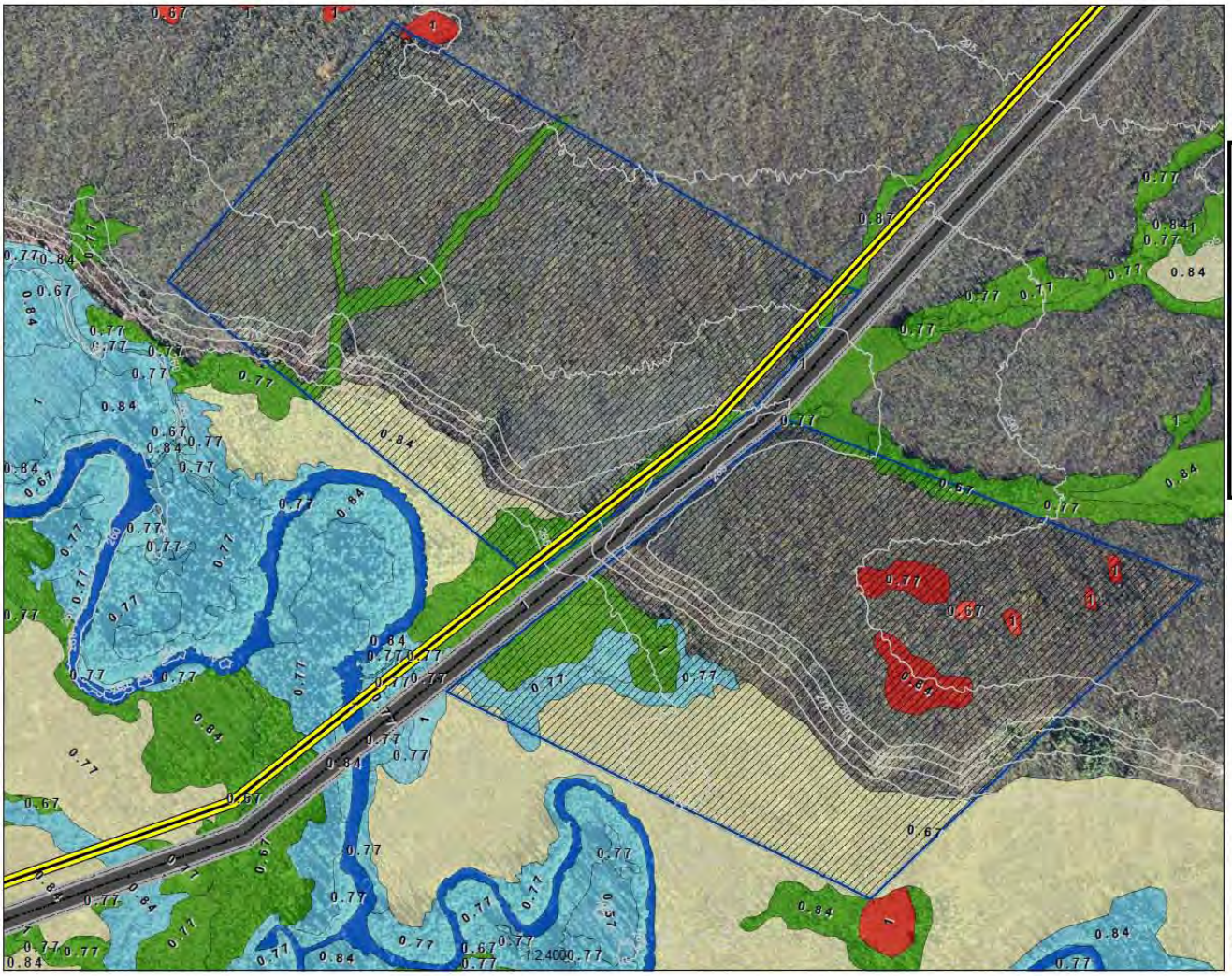
To produce FCI's outside of direct impact areas we determined it was possible to group FCI results from field and EFA plots by HGM and vegetation type, and apply the average score for each function to unrated polygons with the same HGM and vegetation type.

This process enables calculations of the estimated functional capacity, by function, for all acres mapped within each Ecoregion and HUC10 basin in the FA study area.



Going back to the checkbook analogy --- this process allows us to estimate the "net worth" of all the wetland areas mapped in ecological terms (within the constraints of the Magee models of course!) – what we refer to as the baseline condition in the FA report.

Nearly Ready to Assess Impacts…



FCU = Functional Capacity Units = FCI x Acres

Please note -- developers of HGM would have me publically stoned if I failed to mention, that in their development process – the evaluation of impacts was always expected to be HGM class by HGM class…not across classes.

Unfortunately this isn't terribly practical in alternatives analysis work – which is why the Magee method was ultimately developed.

Balancing the Checkbook…

Baseline "Credits" by Function: HUC10 "X" (100,000 acres)		**Project "Debits" by Function**: Facility "A" in HUC10 "X" (100 acres)		**Percent Loss**
Model 1 FCUs:	2,000	Model 1 FCUs:	-25.0	1.25
Model 2 FCUs:	1,250	Model 2 FCUs:	-35.0	2.80
Model 3 FCUs:	2,500	Model 3 FCUs:	-15.0	0.60
Model 4 FCUs:	500	Model 4 FCUs:	-50.0	10.00
Model 4 FCUs:	750	Model 4 FCUs:	- 5.0	0.67
Model 6 FCUs:	1,250	Model 6 FCUs:	-12.5	1.00
Model 7 FCUs:	3,250	Model 7 FCUs:	-72.5	2.23
Model 8 FCUs:	3,500	Model 8 FCUs:	-35.0	1.00
Total FCU Credits	15,000	Total FCU Debits	-250.0	

So, how much total function (FCUs) do we have left in the bank if Facility "A" is constructed without any mitigation?

Which function is going to take the biggest "hit" from Facility A?

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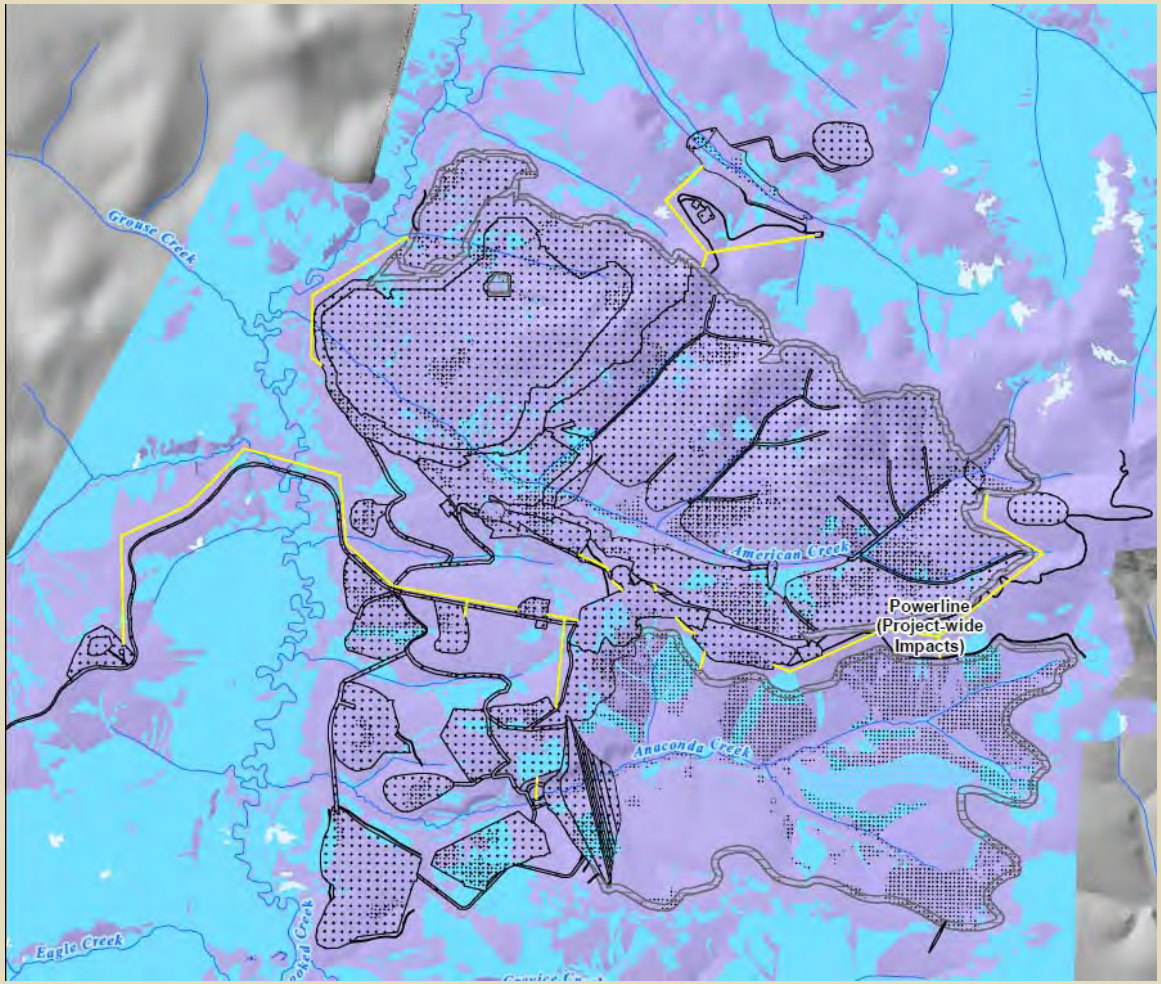
Donlin Gold Project
Wetland Functional Assessment Results



Baseline (Pre-Project) Projections by Function

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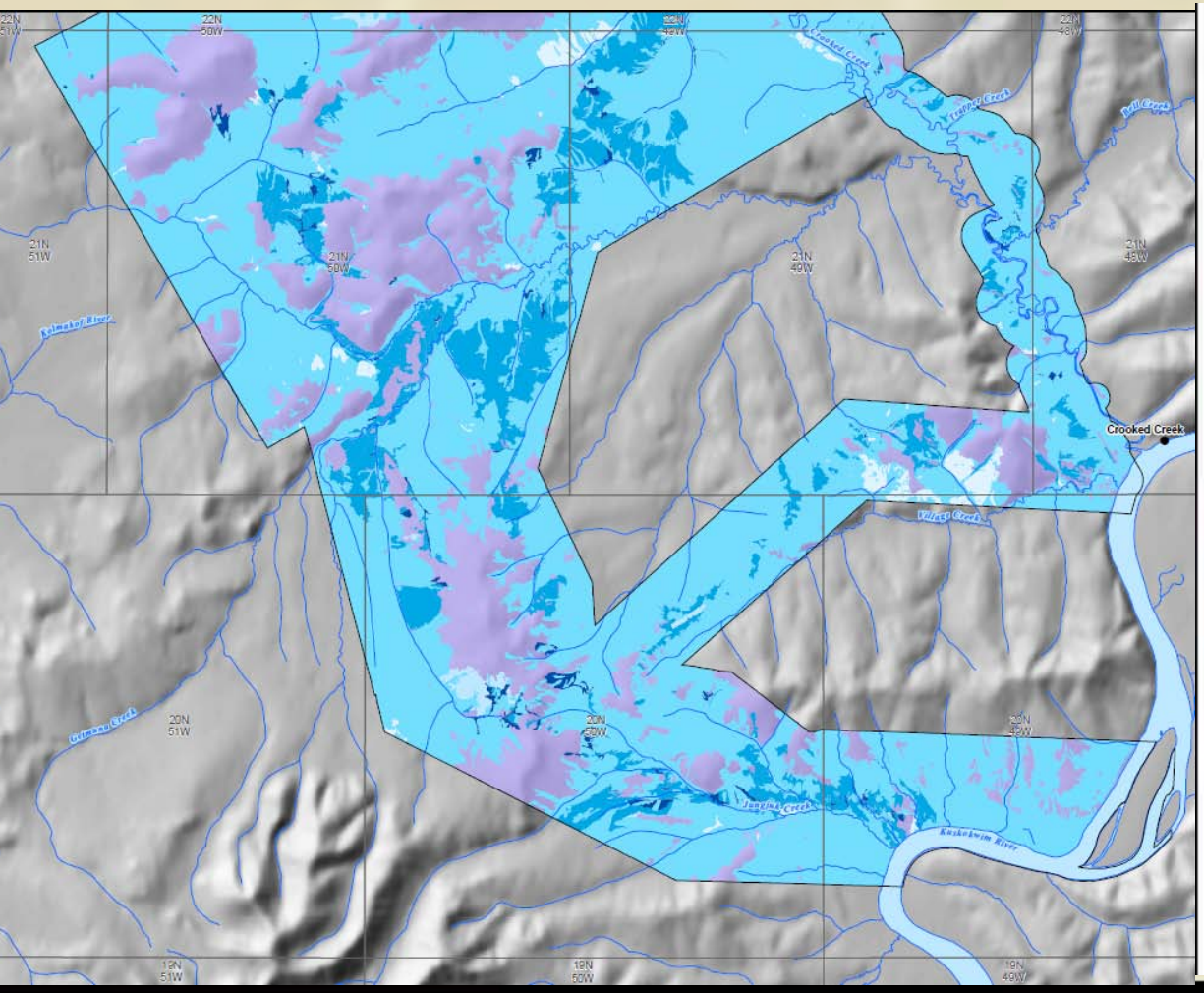
Magee Model 1: Modification of Groundwater Discharge

FSA Total FCUs = 26,540.31 PSA Total FCUs = 30,130.99 Total FCUs = 56,671.30



Modification of Groundwater Discharge Function (Model 1)
FSA Overview
Figure 3.1-1A

Legend

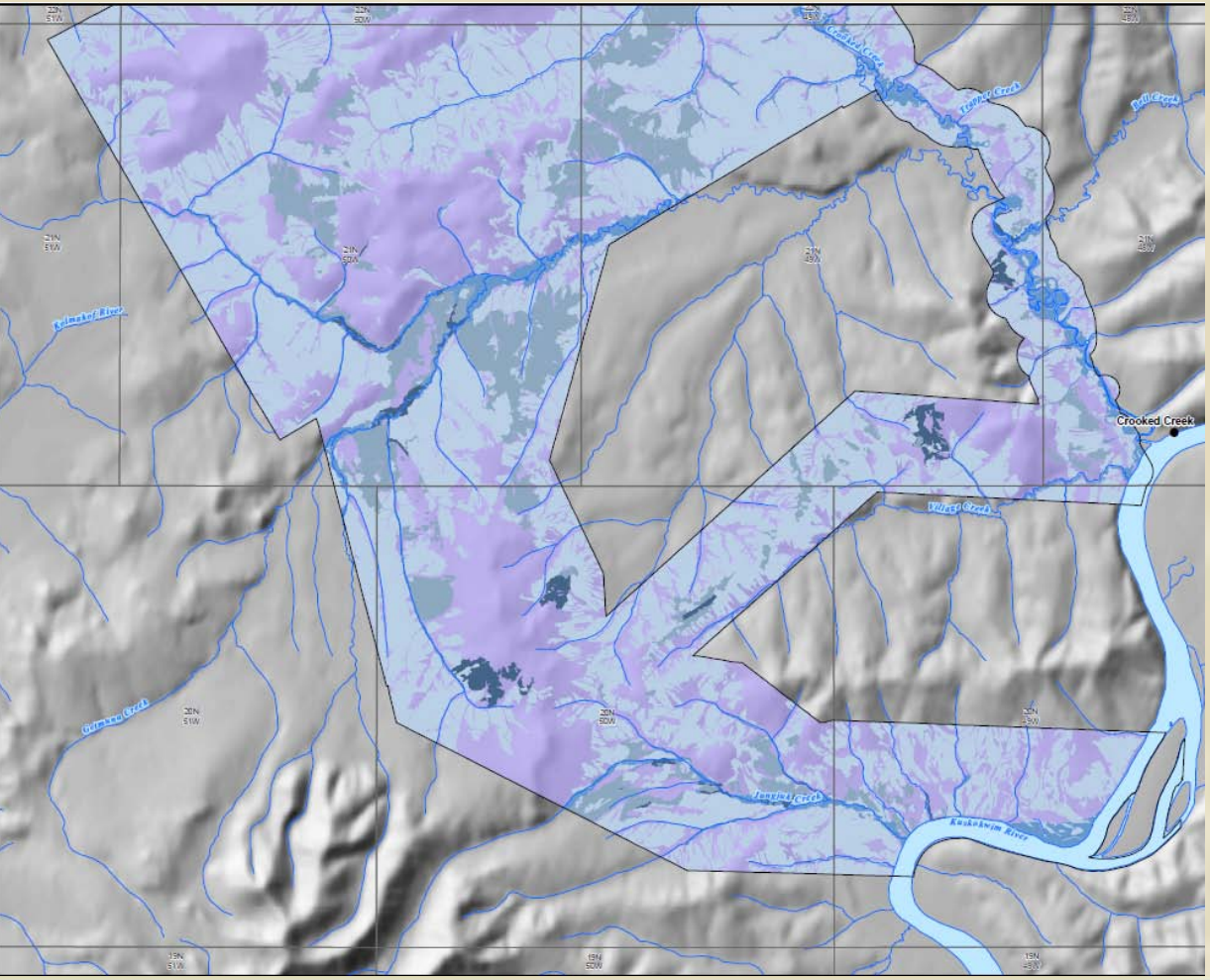
- FSA Study Area

FCI Model 1

- High (>=0.660 And <=1.0)
- High (>=0.660 And <=1.0) derived
- Moderate (>=0.330 And <0.660)
- Moderate (>=0.330 And <0.660) derived
- Low (>=0 And <0.330)
- Low (>=0 And <0.330) derived
- Not Evaluated (Predominantly Non-Wetlands)
- Township/Range Grid (BLM)
- Rivers (USGS NHD)

Magee Model 2: Modification of Groundwater Recharge

FSA Total FCUs = 23,830.95 PSA Total FCUs = 19,545.02 Total FCUs = 43,375.97



Modification of Groundwater Recharge Function (Model 2)
FSA Overview
Figure 3.1-2A

Legend

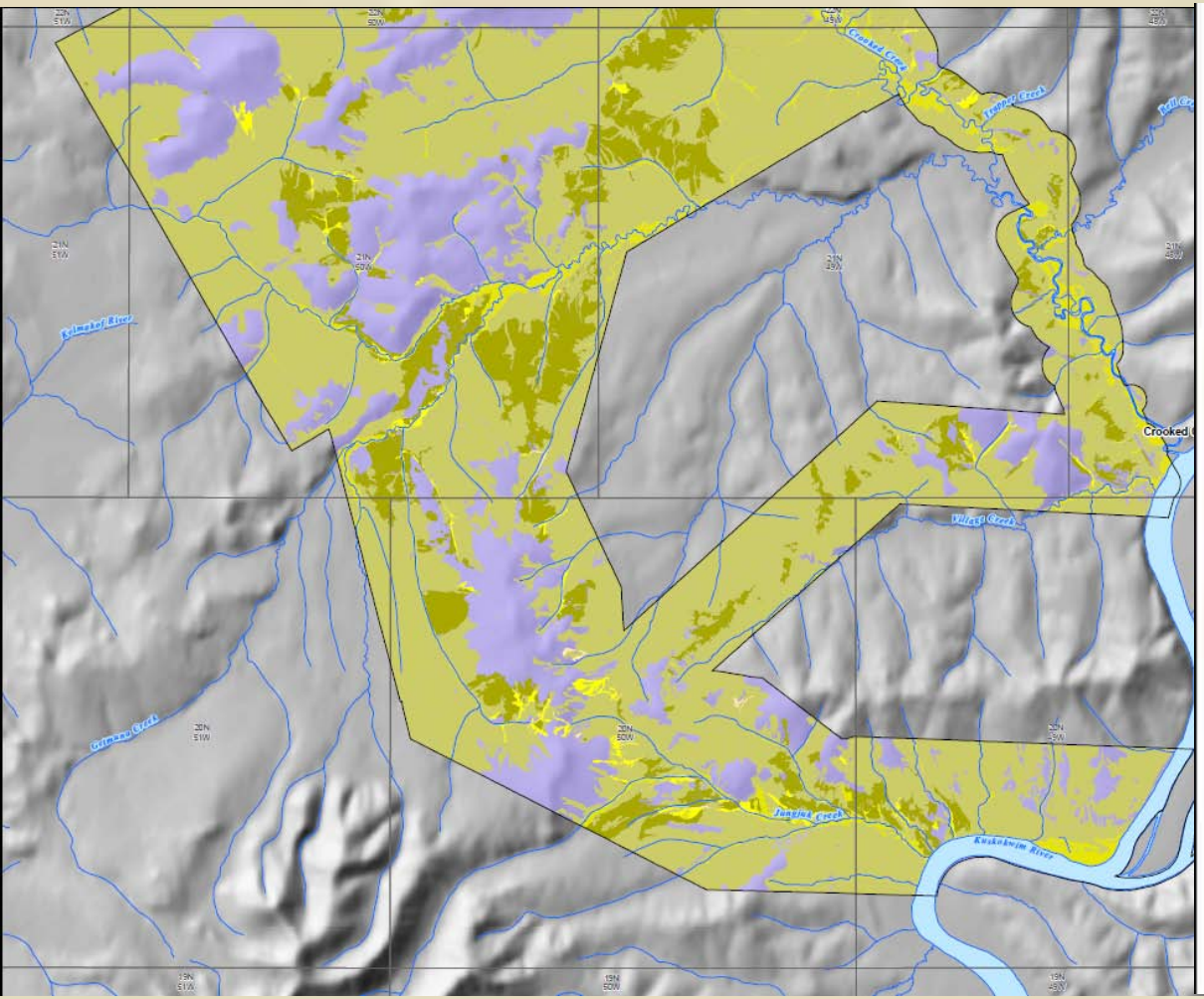
- FSA Study Area

FCI Model 2

- High (>=0.660 And <=1.0)
- High (>=0.660 And <=1.0) derived
- Moderate (>=0.330 And <0.660)
- Moderate (>=0.330 And <0.660) derived
- Low (>=0 And <0.330)
- Low (>=0 And <0.330) derived
- Not Evaluated (Predominantly Non-Wetlands)
- Township/Range Grid (BLM)
- Rivers (USGS NHD)

Magee Model 3: Storm and Floodwater Storage

FSA Total FCUs = 52,959.79 PSA Total FCUs = 50,474.29 Total FCUs = 103,434.08



Storm and Flood-Water Storage Function (Model 3)
FSA Overview
Figure 3.1-3A

Legend

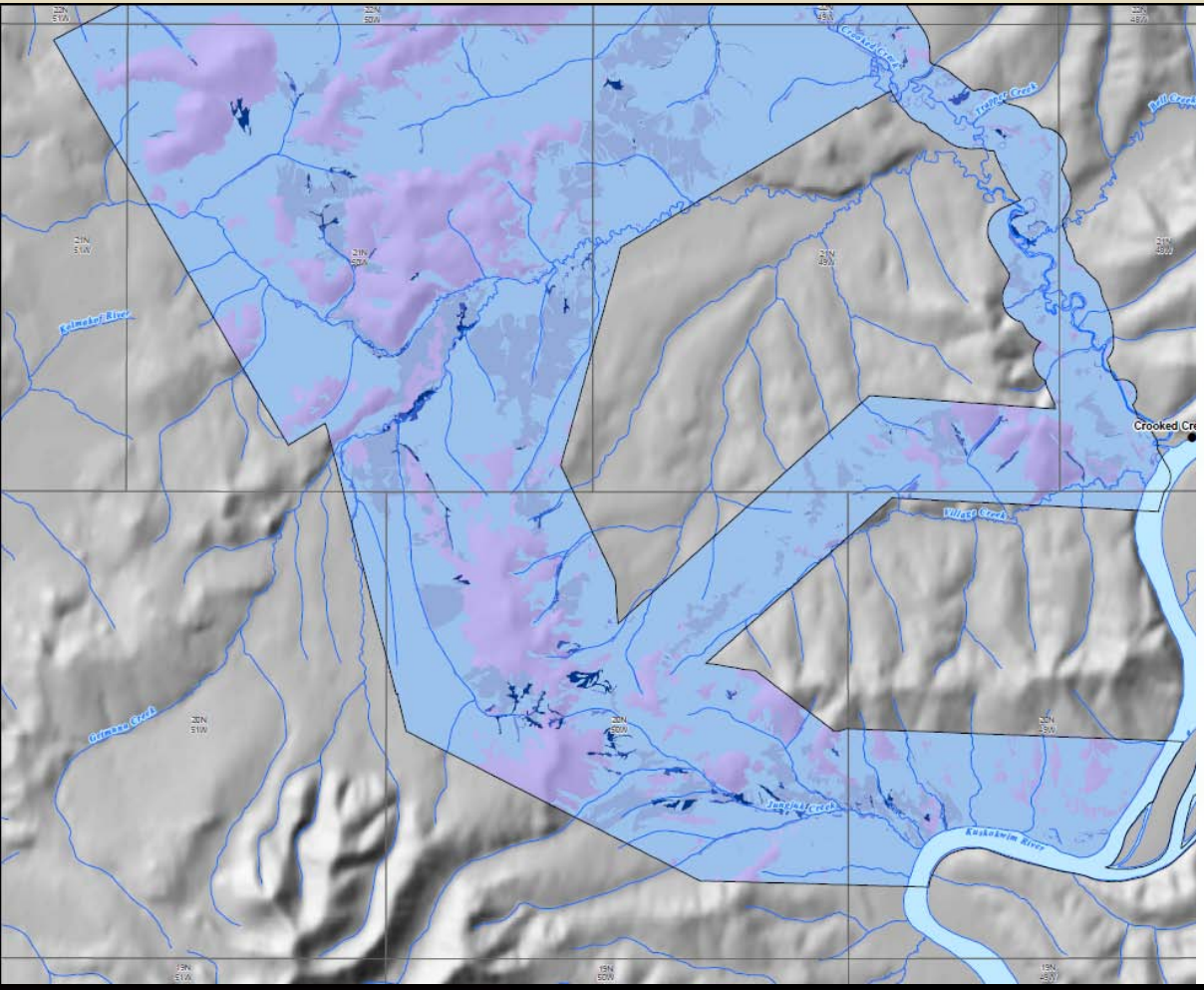
- FSA Study Area

FCI Model 3

- High (>=0.660 And <=1.0)
- High (>=0.660 And <=1.0) derived
- Moderate (>=0.330 And <0.660)
- Moderate (>=0.330 And <0.660) derived
- Low (>=0 And <0.330)
- Low (>=0 And <0.330) derived (NA)
- Not Evaluated (Predominantly Non-Wetlands)
- Township/Range Grid (BLM)
- Rivers (USGS NHD)

Magee Model 4: Modification of Stream Flow

FSA Total FCUs = 3,312.00 PSA Total FCUs = 7,440.01 Total FCUs = 10,752.01



Modification of Stream Flow
Function (Model 4)
FSA Overview
Figure 3.1-4A

Legend

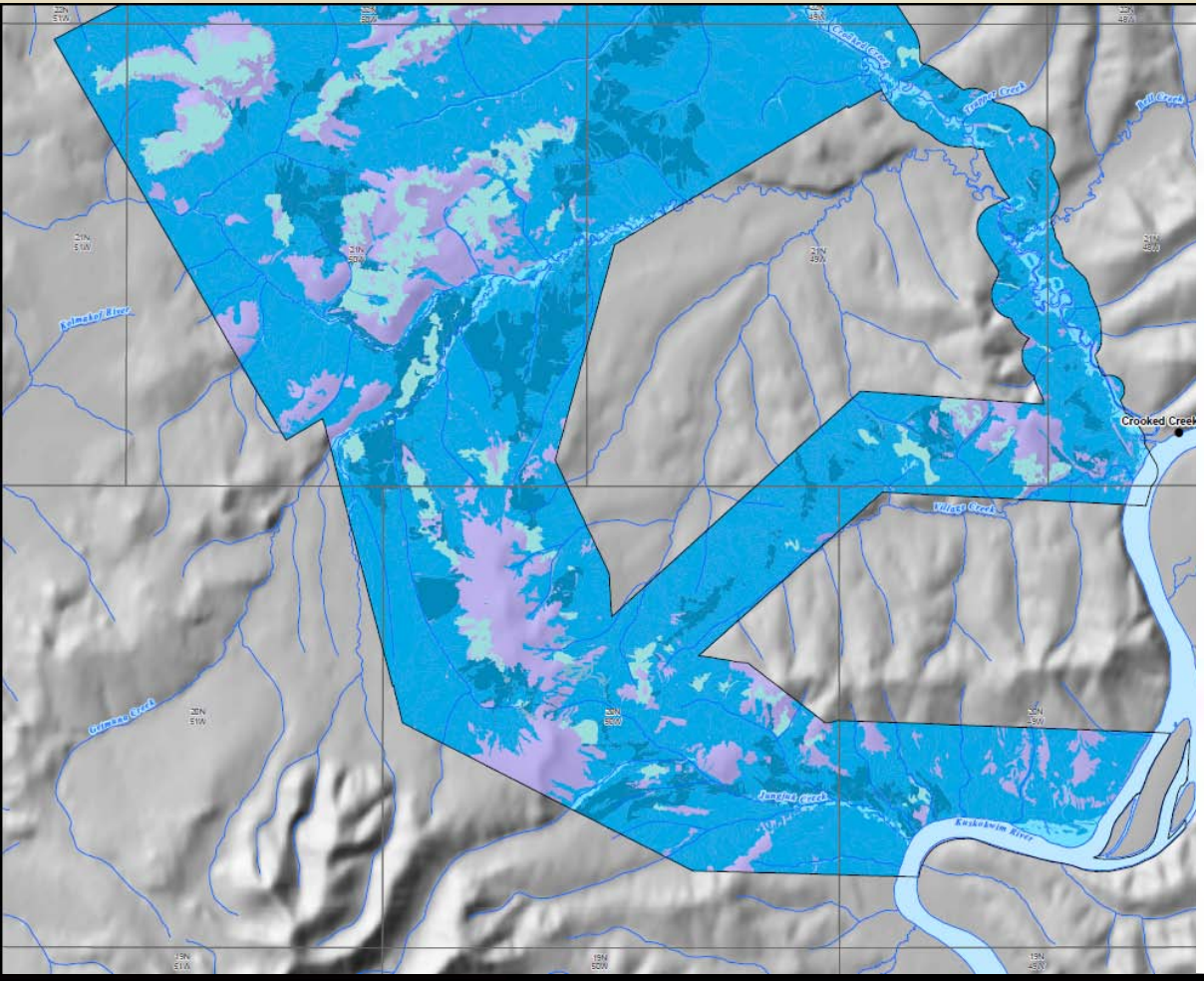
FSA Study Area

FCI Model 4

- High (>=0.660 And <=1.0)
- High (>=0.660 And <=1.0) derived
- Moderate (>=0.330 And <0.660)
- Moderate (>=0.330 And <0.660) derived
- Low (>=0 And <0.330)
- Low (>=0 And <0.330) derived
- Not Evaluated (Predominantly Non-Wetlands)
- Township/Range Grid (BLM)
- Rivers (USGS NHD)

Magee Model 5: Modification of Water Quality

FSA Total FCUs = 48,802.24 PSA Total FCUs = 48,927.75 Total FCUs = 97,729.99



Modification of Water Quality
Function (Model 5)
FSA Overview
Figure 3.1-5A

Legend

FSA Study Area

FCI Model 5

High (>=0.660 And <=1.0)

High (>=0.660 And <=1.0) derived

Moderate (>=0.330 And <0.660)

Moderate (>=0.330 And <0.660) derived

Low (>=0 And <0.330)

Low (>=0 And <0.330) derived

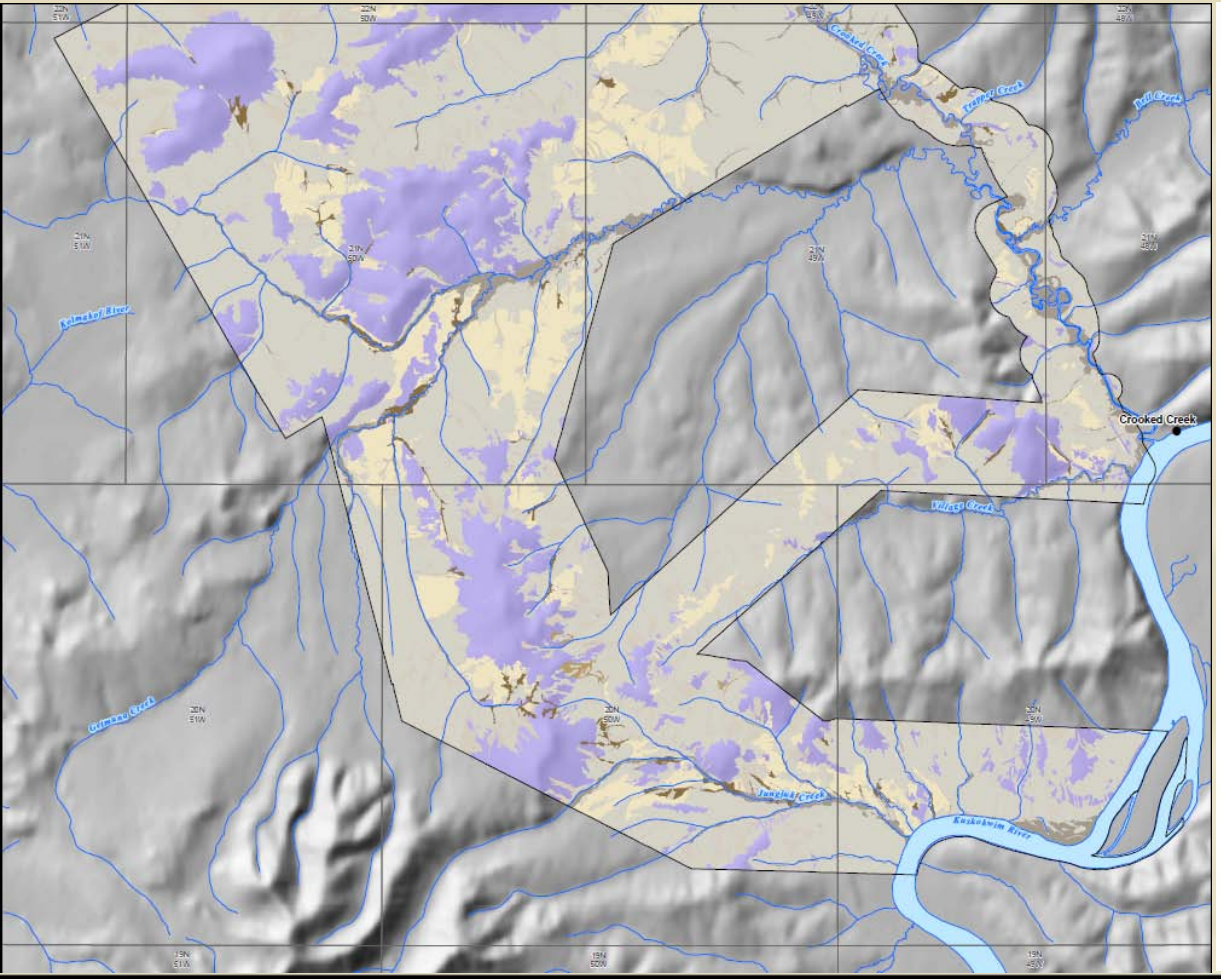
Not Evaluated
(Predominantly Non-Wetlands)

Township/Range Grid (BLM)

Rivers (USGS NHD)

Magee Model 6: Export of Detritus

FSA Total FCUs = 5,861.26 PSA Total FCUs = 13,320.88 Total FCUs = 19,182.14



Export of Detritus, Function (Model 6)
FSA Overview
Figure 3.1-6A

Legend

- FSA Study Area

FCI Model 6

- High (>=0.660 And <=1.0)
- High (>=0.660 And <=1.0) derived
- Moderate (>=0.330 And <0.660)
- Moderate (>=0.330 And <0.660) derived
- Low (>=0 And <0.330)
- Low (>=0 And <0.330) derived
- Not Evaluated (Predominantly Non-Wetlands)
- Township/Range Grid (BLM)
- Rivers (USGS NHD)

Magee Model 7: Contribution to Abundance & Diversity of Wetland Vegetation

FSA Total FCUs = 48,363.51 PSA Total FCUs = 51,545.02 Total FCUs = 99,908.53

Contribution of Abundance and Diversity of Wetland Vegetation, Function (Model 7)
FSA Overview
Figure 3.1-7A

Legend

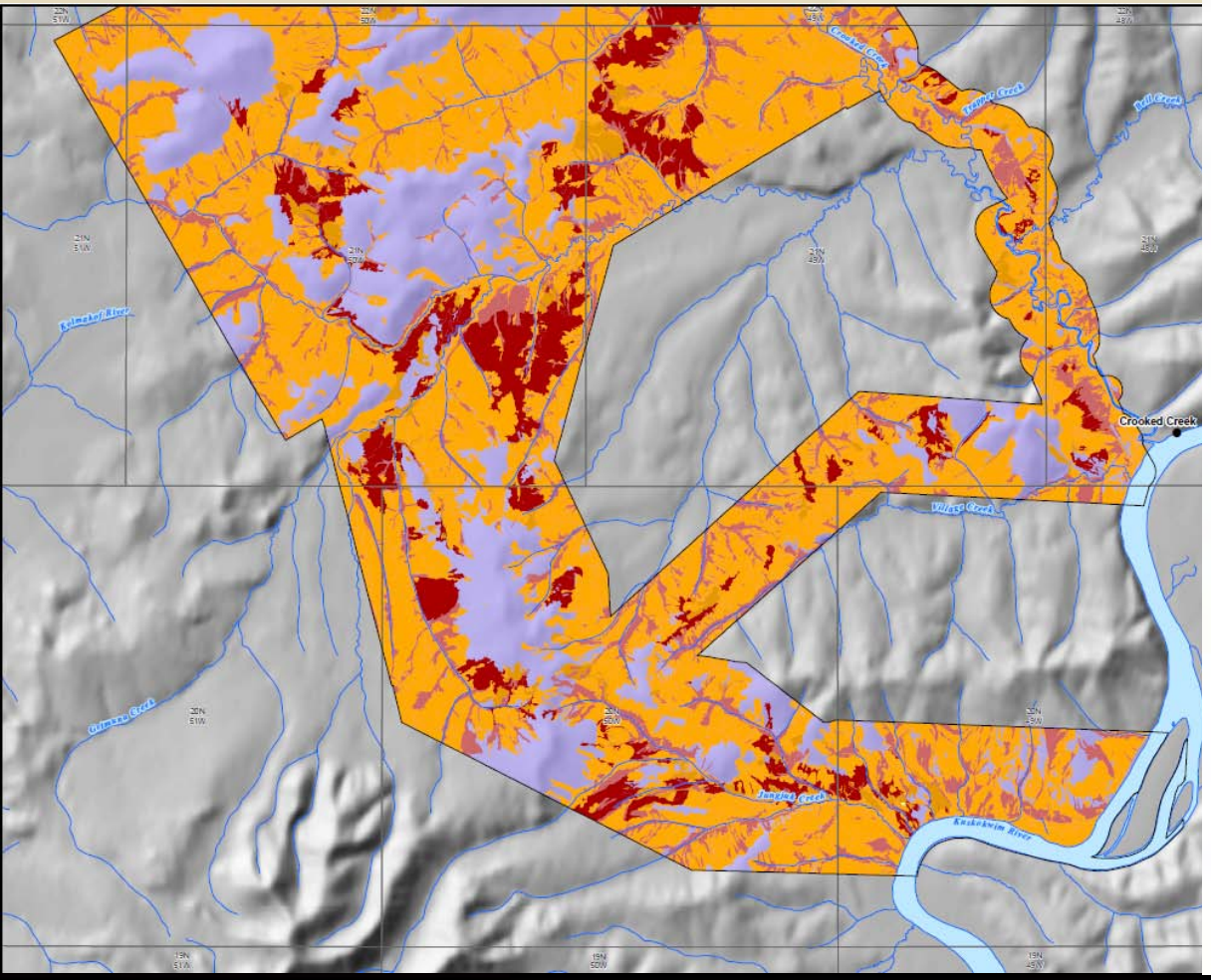
- FSA Study Area

FCI Model 7

- High (>=0.660 And <=1.0)
- High (>=0.660 And <=1.0) derived
- Moderate (>=0.330 And <0.660)
- Moderate (>=0.330 And <0.660) derived
- Low (>=0 And <0.330)
- Low (>=0 And <0.330) derived (NA)
- Not Evaluated (Predominantly Non-Wetlands)
- Township/Range Grid (BLM)
- Rivers (USGS NHD)

Magee Model 8: Contribution to Abundance & Diversity of Wetland Fauna

FSA Total FCUs = 36,583.97 PSA Total FCUs = 38,134.83 Total FCUs = 74,718.80



Contribution of Abundance and Diversity of Wetland Fauna, Function (Model 8)
FSA Overview
Figure 3.1-8A

Legend

- FSA Study Area

FCI Model 8

- High (>=0.660 And <=1.0)
- High (>=0.660 And <=1.0) derived
- Moderate (>=0.330 And <0.660)
- Moderate (>=0.330 And <0.660) derived
- Low (>=0 And <0.330)
- Low (>=0 And <0.330) derived (NA)
- Not Evaluated (Predominantly Non-Wetlands)
- Township/Range Grid (BLM)
- Rivers (USGS NHD)

FSA Baseline Functional Capacity Units by HGM Class

Overview of FSA Baseline Functional Capacity Units by HGM Class for the Donlin Gold Project

HGM Class	Total Acres Evaluated	Total Wetland Acres Evaluated	Baseline Functional Capacity Units by Wetland Function for the FSA[a,b]								
			ModGw Discharge	ModGw Recharge	StrFld Storage	ModStr Flow	ModWa Quality	Exp Detritus	Abund& DiverVeg	Abund& DiverFauna	Total FCUs
Riverine	4,211.79	2,693.08	1,511.97	1,928.63	1,657.41	898.56	2,162.15	2,257.44	2,320.22	1,668.01	14,404.39
Slope	17,319.18	11,636.04	6,762.74	0.00	9,910.07	2,129.75	10,150.08	3,151.87	10,439.07	7,802.02	50,345.59
Depressional	138.17	137.51	65.66	72.16	116.88	20.73	103.85	28.12	105.60	81.08	594.08
Flat	62,700.42	41,562.91	18,199.94	21,830.16	41,275.44	262.96	36,386.17	423.82	35,498.63	27,032.85	180,909.97
Lacustrine Fringe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-wetlands	20,635.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other[c]	1,398.96	1,396.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Totals	**106,404.40**	**57,426.48**	**26,540.31**	**23,830.95**	**52,959.79**	**3,312.00**	**48,802.24**	**5,861.26**	**48,363.51**	**36,583.97**	**246,254.04**

Notes:

a. Inconsistencies in sums are the result of rounding.

b. Values from RDI Excel spreadsheet titled *DG_FCU_FSA_Analysis_140409.xlsx*.

c. Other includes 1,396.94 acres mapped as HGM class riverine channel, but excludes 2.02 acres of man-made sediment retention ponds (see Section 2.2.1).

Similar tables are available in the report by Ecoregion, HUC10, and Vegetation Type

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PSA Baseline Functional Capacity Units by HGM Class

Overview of PSA Baseline Functional Capacity Units by HGM Class for the Donlin Gold Project

HGM Class	Total Acres Evaluated	Acres Evaluated by HGM Class	Baseline Functional Capacity Units (FCUs) by Wetland Function for the PSA[a,b] ModGw Discharge	ModGw Recharge	StrFld Storage	ModStr Flow	ModWa Quality	Exp Detritus	Abund& DiverVeg	Abund& DiverFauna	Total FCUs
Riverine	12,522.72	6,035.60	3,292.69	4,516.56	3,742.80	2,004.79	4,820.10	5,151.84	5,408.89	3,805.21	32,742.88
Slope	31,743.94	21,887.03	13,005.53	0.00	18,704.68	4,291.47	18,976.10	6,316.18	19,928.72	14,822.74	96,045.43
Depressional	1,479.56	1,455.86	757.18	713.19	1,119.36	296.12	986.06	389.61	1,037.47	820.68	6,119.67
Flats	46,070.49	27,858.05	13,075.59	14,302.28	26,892.97	847.62	24,124.61	1,447.13	25,150.17	18,671.72	124,512.09
Lacustrine Fringe	36.57	34.76	0.00	12.98	14.48	0.00	20.88	16.12	19.77	14.47	98.71
Non-wetlands	87,251.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other[c]	6,970.38	6,970.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Totals	**186,074.76**	**64,241.65**	**30,131.00**	**19,545.01**	**50,474.29**	**7,440.01**	**48,927.76**	**13,320.88**	**51,545.02**	**38,134.83**	**259,518.80**

Notes:

a. Inconsistencies in sums are the result of rounding.

b. Values from RDI Excel spreadsheet titled *DG_PSA_FCU_140408.xlsx*.

c. Other includes acres mapped as HGM class riverine channel and lacustrine waters (see Section 2.2.1).

Similar tables are available in the report by Ecoregion, HUC10, and Vegetation Type

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Combined Baseline Functional Capacity Units by HGM Class (FSA + PSA)

Overview of Baseline Functional Capacity Units by HGM Class for the Donlin Gold Project

HGM Class	Total Acres Evaluated	Total Acres Evaluated by HGM Type	Baseline Functional Capacity Units by Wetland Function[a,b,c]																Total FCUs
			ModGw Discharge	% Total	ModGw Recharge	% Total	StrFld Storage	% Total	ModStr Flow	% Total	ModWa Quality	% Total	Exp Detritus	% Total	Abund& DiverVeg	% Total	Abund& DiverFauna	% Total	
Riverine - FSA	4,211.79	2,693.08	1,511.97	2.7	1,928.63	4.4	1,657.41	1.6	898.56	8.4	2,162.15	2.2	2,257.44	11.8	2,320.22	2.3	1,668.01	2.2	14,404.39
Riverine - PSA	12,522.72	6,035.60	3,292.69	5.8	4,516.56	10.4	3,742.80	3.6	2,004.79	18.6	4,820.10	4.9	5,151.84	26.9	5,408.89	5.4	3,805.21	5.1	32,742.88
Subtotal	16,734.51	8,728.68	4,804.66	8.5	6,445.19	14.9	5,400.21	5.2	2,903.35	27.0	6,982.25	7.1	7,409.28	38.6	7,729.11	7.7	5,473.22	7.3	47,147.27
Slope - FSA	17,319.18	11,636.04	6,762.74	11.9	0.00	0.0	9,910.07	9.6	2,129.75	19.8	10,150.08	10.4	3,151.87	16.4	10,439.07	10.4	7,802.02	10.4	50,345.59
Slope - PSA	31,743.94	21,887.03	13,005.53	22.9	0.00	0.0	18,704.68	18.1	4,291.47	39.9	18,976.10	19.4	6,316.18	32.9	19,928.72	19.9	14,822.74	19.8	96,045.43
Subtotal	49,063.12	33,523.07	19,768.27	34.9	0.00	0.0	28,614.75	27.7	6,421.22	59.7	29,126.18	29.8	9,468.05	49.4	30,367.79	30.4	22,624.76	30.3	146,391.02
Depressional - FSA	138.17	137.51	65.73	0.1	72.16	0.2	116.88	0.1	20.73	0.2	103.85	0.1	28.12	0.1	105.60	0.1	81.08	0.1	594.08
Depressional - PSA	1,479.56	1,455.86	757.18	1.3	713.19	1.6	1,119.36	1.1	296.12	2.8	986.06	1.0	389.61	2.0	1,037.47	1.0	820.68	1.1	6,119.67
Subtotal	1,617.73	1,593.37	822.91	1.5	785.35	1.8	1236.24	1.2	316.85	2.9	1089.91	1.1	417.73	2.2	1143.07	1.1	901.76	1.2	6,713.75
Flats- FSA	62,700.42	41,562.91	18,199.94	32.1	21,830.16	50.3	41,275.44	39.9	262.96	2.4	36,386.17	37.2	423.82	2.2	35,498.63	35.5	27,032.85	36.2	180,909.97
Flats- PSA	46,070.49	27,858.05	13,075.59	23.1	14,302.28	33.0	26,892.97	26.0	847.62	7.9	24,124.61	24.7	1,1447.13	59.7	25,150.17	25.2	18,671.72	25.0	124,512.09
Subtotal	108,770.91	69,420.96	31,275.53	55.2	36,132.44	83.3	68,168.41	65.9	1,110.58	10.3	60,510.78	61.9	11,870.95	61.9	60,648.80	60.7	45,704.57	61.2	305,422.06
Lacustrine Fringe - FSA	0.00	0.00	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Lacustrine Fringe - PSA	36.57	34.76	0.00	0.0	12.98	0.0	14.48	0.0	0.00	0.0	20.88	0.0	16.12	0.1	19.77	0.0	14.47	0.0	98.71
Subtotal	36.57	34.76	0.00	0.0	12.98	0.0	14.48	0.0	0.00	0.0	20.88	0.0	16.12	0.1	19.77	0.0	14.47	0.0	98.71
Non-wetlands - FSA	20,635.88	0.00	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Non-wetlands - PSA	87,251.11	0.00	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Subtotal	107,886.99	0.00	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Other[d] - FSA	1,398.96	1,398.96	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Other[e] - PSA	6,970.38	6,970.35	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Subtotal	8,369.34	8,367.29	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
FSA Subtotals	106,404.40	57,426.48	26,540.31	46.8	23,830.95	54.9	52,959.79	51.2	3,312.00	30.8	48,802.24	49.9	5,861.26	30.6	48,363.51	48.4	36,583.97	49.0	246,254.04
PSA Subtotals	186,074.76	64,241.65	30,130.99	53.2	19,545.02	45.1	50,474.29	48.8	7,440.01	69.2	48,927.75	50.1	13,320.88	69.4	51,545.02	51.6	38,134.83	51.0	259,518.77
Totals	**292,479.16**	**121,670.15**	**56,671.30**	**11.2**	**43,375.97**	**8.6**	**103,434.08**	**20.4**	**10,752.01**	**2.1**	**97,729.99**	**19.3**	**19,182.14**	**3.8**	**99,908.53**	**19.8**	**74,718.80**	**14.8**	**505,772.81**

Notes:

a. Inconsistencies in sums are the result of rounding.
b. Values from RDI Excel spreadsheet titled *DG_FCU_FSA_Analysis _1400409.xlsx*.
c. Values from RDI Excel spreadsheet titled *DG_FCU_PSA_Analysis _1400408.xlsx*.
d. Includes 1,396.94 acres mapped as HGM class riverine channel, and 2.02 acres of man-made sediment retention ponds (see Section 2.2.1).
e. Includes 6,970.38 acres mapped as HGM class riverine channel and lacustrine waters (see Section 2.2.1).

Percent Totals by Function Across Entire Donlin Gold Evaluation Area

		Total FCUs	% Total
Model 1 FCUs:	ModGWDischarge	= 56,671	11.2
Model 2 FCUs:	ModGWRecharge	= 43,376	8.6
Model 3 FCUs:	StrFlodStorage	= 103,434	20.4
Model 4 FCUs:	ModStrFlow	= 10,752	2.1
Model 5 FCUs:	ModWaQuality	= 97,730	19.3
Model 6 FCUs:	ExpDetritus	= 19,182	3.8
Model 7 FCUs:	Abund&DiverVeg	= 99,908	19.8
Model 8 FCUs:	Abund&DiverFauna	= 74,719	14.8
		505,772	**100.0**

Total Wetland Area Evaluated = 121,668 Acres

Total Area Evaluated = 292,479 Acres

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Back to the Checkbook!

Baseline "Credits" and Average FCI by Function

			AVE FCI
Model 1 FCUs:	ModGWDischarge	= 56,671	0.47
Model 2 FCUs:	ModGWRecharge	= 43,376	0.36
Model 3 FCUs:	StrFlodStorage	= 103,434	0.85
Model 4 FCUs:	ModStrFlow	= 10,752	0.09
Model 5 FCUs:	ModWaQuality	= 97,730	0.80
Model 6 FCUs:	ExpDetritus	= 19,182	0.16
Model 7 FCUs:	Abund&DiverVeg	= 99,908	0.82
Model 8 FCUs:	Abund&DiverFauna	= 88,210	0.73
Total FCU Credits		= 505,773	0.52

Total Wetland Area Evaluated = 121,668 Acres

Total Area Evaluated = 292,479 Acres

Remember, averages will vary by ecoregion and HUC

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Average FCIs by Ecoregion (Table 3.3-1)

Kuskokwim Mountains	= 0.54 (FSA & PSA)
Alaska Range	= 0.42 (PSA Only)
Cook Inlet Basin	= 0.54 (PSA Only)
Tanana-Kuskokwim Lowlands	= 0.54 (PSA Only)

Average FCIs by HGM Type (Table 3.3-2)

Riverine	= 0.68 (FSA & PSA)
Slope	= 0.55 (FSA & PSA)
Depressional	= 0.53 (FSA & PSA)
Flat	= 0.55 (FSA & PSA)
Lacustrine Fringe	= 0.35 (PSA Only)

Remember – while its always tempting to use the averages, the average FCI from function to function varies significantly

The FA report also presents Average FCIs by Vegetation type – but they won't all fit on one PowerPoint slide….

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SUMMARY OF ANTICIPATED FSA & PSA DIRECT WETLAND IMPACTS

Wetlands (acres)

FSA	=	5,666.88
PSA	=	1,414.93
TOTAL	**=**	**7,081.81**

Small Streams & Drainages (miles)

Intermittent	=	3.11
Perennial	=	15.36
TOTAL	**=**	**18.47**

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SUMMARY OF ANTICIPATED FSA & PSA DIRECT WETLAND IMPACTS*

Magee HGM Type (nearest whole acre except LF):

		FSA		PSA		TOTAL
Riverine	=	154	+	76	=	230
Slope	=	854	+	501	=	1,355
Depressional	=	3	+	15	=	18
Flat	=	4,653	+	795	=	5,448
Lacustrine Fringe	=	*0*	+	*0.25*	=	*0.25*
TOTAL	=	**5,664**	+	**1,387**	=	**7,051**

Non-Magee Types (acres)

Riverine Channel	=	2.96	+	30.25	=	33.21
Lacustrine	=	0.00	+	0.36	=	0.36

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The report contains individual tables for each proposed facility, with its associated debits calculated by function. Each function has a unique figure color palette.

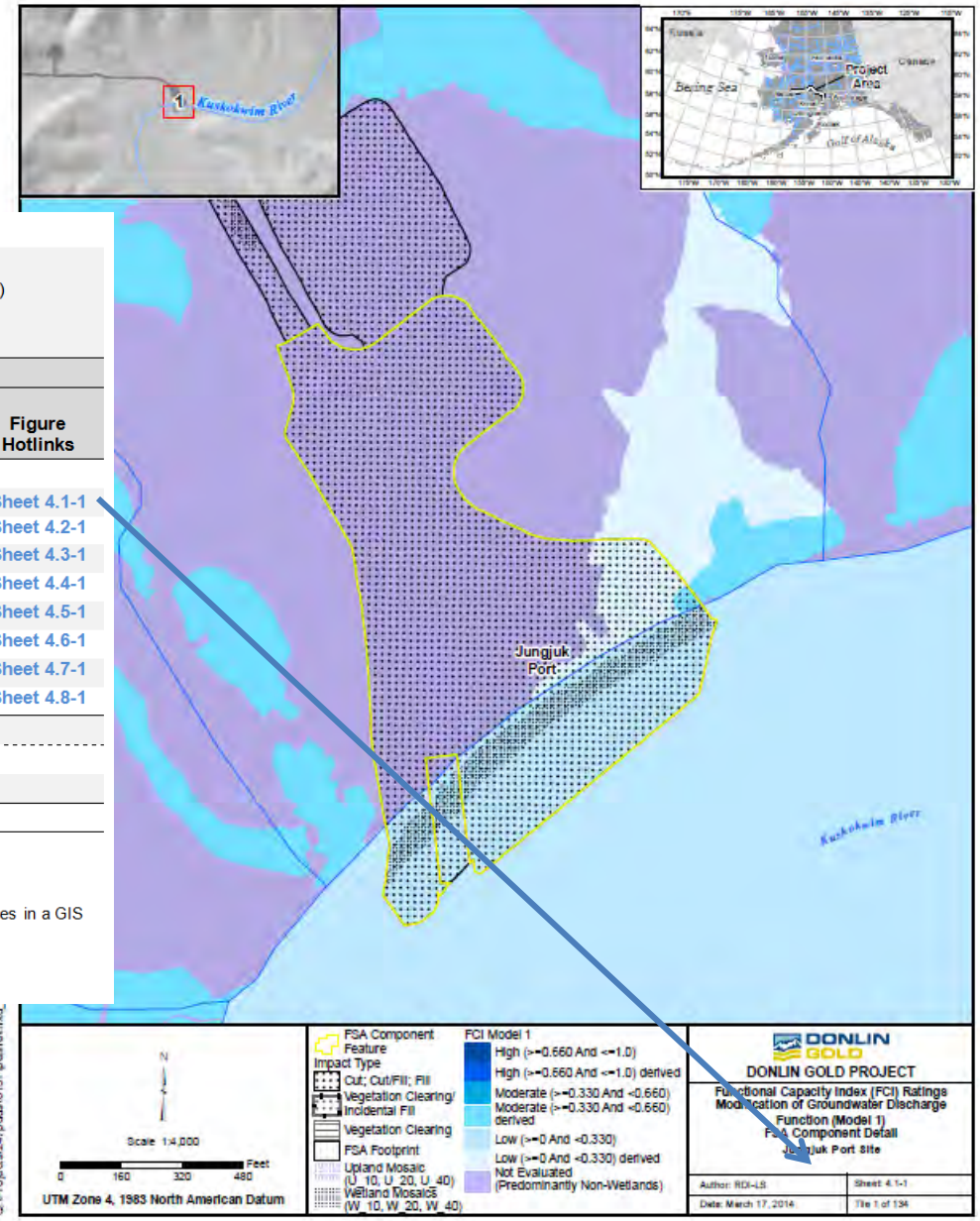
Calculated FCU Debits by Function for Jungjuk Port

Jungjuk Port[a]	**FSA Facility 1**
Total Footprint: 20.33 acres (8.23 ha)	Wetland Impacts: 10.72 acres (4.34 ha)
Construction Start Year: 2016 (Year 1)	Impact Duration: Permanent
Wetland Fills Removed at Closure: No	Revegetation at Closure: Yes

	Calculated FCU Debits (FCI x Acres Impacted) by HGM Class[b,c]						
Function[d] (Wetland Acres)[e]	**Riverine (2.54)**	**Slope (0.93)**	**Depressional (0.00)**	**Flat (5.10)**	**Lacustrine Fringe (0.00)**	**Totals**	**Figure Hotlinks**
Cut/Fill Impacts							
ModGwDischarge	-2.16	-0.40	0.00	-2.26	0.00	-4.82	Sheet 4.1-1
ModGwRecharge	-0.81	0.00	0.00	-2.66	0.00	-3.47	Sheet 4.2-1
StrFldStorage	-1.53	-0.92	0.00	-5.09	0.00	-7.54	Sheet 4.3-1
ModStrFlow	-1.44	-0.01	0.00	-0.01	0.00	-1.46	Sheet 4.4-1
ModWaQuality	-2.45	-0.87	0.00	-4.32	0.00	-7.64	Sheet 4.5-1
ExpDetritus	-2.23	-0.02	0.00	-0.01	0.00	-2.26	Sheet 4.6-1
Abund&DiverVeg	-2.01	-0.81	0.00	-4.28	0.00	-7.10	Sheet 4.7-1
Abund&DiverFauna	-1.68	-0.64	0.00	-3.17	0.00	-5.49	Sheet 4.8-1
Subtotal	-14.31	-3.67	0.00	-21.80	0.00	-39.78	
Vegetation Clearing Impacts							
Subtotal	0.00	0.00	0.00	0.00	0.00	0.00	
Total FCU Debits	**-14.31**	**-3.67**	**0.00**	**-21.80**	**0.00**	**-39.78**	

Notes:

a. Includes 2.25 acres below the ordinary high water mark.
b. FCU is functional capacity unit; FCI is functional capacity index; HGM is hydrogeomorphic.
c. Inconsistencies in sums are the result of rounding. FCU impacts for each facility were determined using automated routines in a GIS and are summarized in the document titled: *FSA_Impact_FCI_FCU_Mode1to8_Detail_140409.xlsx*.
d. Magee method wetlands functions; see Section 2 and Appendix B for descriptions.
e. Wetland acres by HGM class do not include 2.15 acres for riverine channel (see Section 2.2.1).



Like the draft 404 permit, the table enables the user to use hotlinks to see associated figures which are stored in appendices.

ADJUSTMENTS TO GIS GENERATED DEBITS

• Current GIS analysis techniques of impacts always assume complete loss of functions in impact areas.

•There are many impacts that will be short term – or temporal.

•There are impact types which do not result in complete losses of all functions – for example removal of trees and large shrubs for powerline corridors does not measureably affect the hydrological characteristics of the area beneath.

•Some functions like storm and floodwater storage, may be all or partially replaced by engineered facilities (dams, dikes, berms, etc.)

ADJUSTMENTS TO GIS GENERATED DEBITS

Powerline (Project-wide Impacts)
Total Footprint: 25.62 acres (10.37 ha)
Construction Start Year: 2016 (Year 1)
Wetland Fills Removed at Closure: N/A

FSA Facility 33
Wetland Impacts: 14.26 acres (5.77 ha)
Impact Duration: 30 years
Revegetation at Closure: If Needed

Function[c] (Wetland Acres)[d]	Calculated FCU Debits (FCI x Acres Impacted) by HGM Class[a,b] Riverine (0.97)	Slope (2.21)	Depressional (0.02)	Flat (11.02)	Lacustrine Fringe (0.00)	Totals	Figure Hotlinks
Cut/Fill Impacts							
Subtotal	0.00	0.00	0.00	0.00	0.00	0.00	
Vegetation Clearing Impacts							
ModGwDischarge	-0.62	-1.46	-0.01	-5.00	0.00	-7.09	Sheet 4.1-33
Adjustments[e]	0.62	1.46	0.01	5.00	0.00	7.09	
ModGwRecharge	-0.69	0.00	-0.01	-5.69	0.00	-6.39	Sheet 4.2-33
Adjustments[e]	0.69	0.00	0.01	5.69	0.00	6.39	
StrFldStorage	-0.64	-1.83	-0.02	-10.92	0.00	-13.41	Sheet 4.3-33
Adjustments[e,f]	0.64	1.83	0.02	10.92	0.00	13.41	
ModStrFlow	-0.47	-0.50	0.00	-0.07	0.00	-1.04	Sheet 4.4-33
Adjustments[e,f]	0.47	0.50	0.00	0.07	0.00	1.04	

e. Assumes no impacts to microtopography (i.e., compaction) occur.
f. Assumes minimal changes to understory species density; however, assumes larger trees will be kept trimmed under the powerline.

When adjustments are made they will appear below the function in the facility table. A table note will explain our assumptions for the adjustment.

Chapter 2 (Methods) of the FA report explains each type of adjustment and how percent change by HGM type is determined (where applicable). In this example, where vegetation variables are not used in the hydrologic function models, cutting down a few large trees will not affect the FCI outputs --- so all debits are offset.

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ADJUSTED DEBITS BY FACILITY AREA IN THE FSA

Summary of Adjusted Functional Capacity Unit Debits for FSA Facilities by Area

FSA Areas	Total Acres	Wetland Acres	Total Adjusted FCU Debits by HGM Class (Wetland Acres)[a,b,c,d] Riverine (154.26)	Slope (853.67)	Depressional (2.85)	Flats (4,653.23)	Lacustrine Fringe (0.00)	Totals
Cut/Fill Impacts								
Lower Jungjuk Creek Area	576.64	126.21	-37.95	-86.72	-0.20	-307.77	0.00	-432.59
Central Crooked Creek Area	304.71	86.98	-5.85	-24.21	0.00	-352.88	0.00	-382.94
Northern East Crooked Creek Terrace Area	1,969.44	1,226.48	-124.77	-675.11	-0.06	-2,939.81	0.00	-3,739.77
Snow Gulch Area	152.17	80.03	-9.91	-11.52	0.00	-73.28	0.00	-94.70
Southern East Crooked Creek Terrace Area	1,027.34	894.19	-8.34	-156.00	-3.48	-1,869.45	0.00	-2,037.22
Anaconda Creek Area	2,403.72	1,727.65	-186.27	-1,098.76	39.66	-4,806.45	0.00	-6,051.82
American Creek Area	3,039.96	1,295.63	-199.37	-592.33	0.00	-4,421.09	0.00	-5,212.81
Subtotal Cut/Fill Impacts	9,473.98	5,437.17	*-572.46*	*-2,644.65*	*35.92*	*-14,770.73*	*0.00*	*-17,951.85*
Vegetation Impacts								
Central Crooked Creek Area	25.46	14.20	-0.23	-0.54	0.00	-2.31	0.00	-3.08
Northern East Crooked Creek Terrace Area	81.57	72.30	-0.27	-8.58	0.00	-23.69	0.00	-32.55
Anaconda Creek Area	238.37	143.19	0.00	-1.04	0.00	-29.59	0.00	-30.62
Subtotal Vegetation Clearing Impacts	345.40	229.69	-0.50	-10.16	0.00	-55.59	0.00	-66.25
Total FSA Acres and Wetland Acres	9,819.38	5,666.86						
Total FSA FCU Post-construction Debits (or Gains)			**-572.96**	**-2,654.81**	**35.92**	**-14,826.32**	**0.00**	**-18,018.10**

Notes:

a. Values are based on assumptions and adjustments detailed in Section 4.0 tables.
b. FCU is functional capacity unit; HGM is hydrogeomorphic.
c. Inconsistencies in sums are the result of rounding.
d. Excludes 2.96 wetland acres for HGM class riverine channel.

CUT/FILL DEBITS BY SEGMENT AREA IN THE PSA

Mileposts (MPs) by Section	Total Acres per Facility	Wetland Acres per Facility	Total Adjusted FCU Debits by HGM Class (Wetland Acres)[a,b,c]					
			Riverine (80.13)	Slope (528.47)	Depressional (15.67)	Flats (835.58)	Lacustrine Fringe (0.25)	Totals
Cut/Fill Impacts								
MP315.2 to MP247.6, Section 6 of Construction Spread 1	664.88	71.89	-11.93	-42.04	-0.05	-231.65	0.00	-285.66
MP247.6 to MP196.6, Section 5 of Construction Spread 1	979.93	253.89	-32.18	-148.05	-1.66	-667.90	0.00	-849.80
MP196.6 to MP144.4, Section 4 of Construction Spread 1	834.99	360.88	-48.66	-163.92	-6.76	-1,176.01	0.00	-1,395.39
MP144.4 to MP126.6, Section 3C of Construction Spread 1	285.38	21.91	-1.35	-14.34	-0.09	-44.23	0.00	-60.01
MP126.6 to MP111.6, Section 3B of Construction Spread 1	283.62	26.15	-35.90	-44.68	-0.02	-3.44	0.00	-84.03
MP111.6 to MP101.8, Section 3A of Construction Spread 1	117.95	27.38	-1.24	-26.46	-0.17	-43.78	0.00	-71.66
MP101.8 to MP50.8, Section 2 of Construction Spread 2	714.48	62.62	-54.21	-40.60	-1.36	-30.82	0.00	-126.98
MP50.8 to MP0, Section 1 of Construction Spread 2	519.46	51.48	-7.20	-62.16	-2.58	-13.71	0.00	-85.63
Cumulative Pipe Storage Yards	11.85	4.20	0.00	-5.23	0.00	-0.26	0.00	-5.49
Adjustments[d]			0.00	0.51	0.00	11.56	0.00	12.07
Cumulative Water Extraction Site Access Facilities	1.45	0.88	-0.04	-3.30	-0.85	0.00	0.00	-4.20
Subtotal Cut/Fill Impacts	*4,413.99*	*881.27*	*-192.72*	*-550.79*	*-13.54*	*-2,211.81*	*0.00*	*-2,968.85*

VEGETATION CLEARING ADJUSED DEBITS IN THE PSA

Mileposts (MPs) by Section	Total Acres per Facility	Wetland Acres per Facility	Total Adjusted FCU Debits by HGM Class (Wetland Acres)[a,b,c]					
			Riverine (80.13)	Slope (528.47)	Depressional (15.67)	Flats (835.58)	Lacustrine Fringe (0.25)	Totals
Vegetation Clearing Impacts								
MP315.2 to MP247.6, Section 6 of Construction Spread 1	317.73	40.10	-1.08	-2.17	0.00	-10.02	0.00	-13.29
MP247.6 to MP196.6, Section 5 of Construction Spread 1	324.73	193.43	-4.33	-31.01	-0.59	-30.95	0.00	-66.87
MP196.6 to MP144.4, Section 4 of Construction Spread 1	242.85	155.71	-1.16	-11.23	-0.33	-35.31	0.00	-48.04
MP144.4 to MP126.6, Section 3C of Construction Spread 1	81.93	8.71	-0.15	-1.46	0.00	-0.58	0.00	-2.20
MP126.6 to MP111.6, Section 3B of Construction Spread 1	67.39	7.66	-0.37	-2.19	-0.01	-0.02	0.00	-2.61
MP111.6 to MP101.8, Section 3A of Construction Spread 1	45.93	16.35	-0.11	-3.17	-0.04	-1.94	0.00	-5.26
MP101.8 to MP50.8, Section 2 of Construction Spread 2	237.35	33.71	-1.37	-6.68	-0.21	-2.80	0.00	-11.07
MP50.8 to MP0, Section 1 of Construction Spread 2	262.95	44.59	-0.97	-9.18	-0.29	-2.90	0.00	-13.33
Cumulative Pipe Storage Yards	72.25	5.60	0.00	-0.59	-0.06	-1.14	0.00	-1.79
Adjustments[d]			0.00	6.57	0.72	15.35	0.00	22.63
Cumulative Water Extraction Site Access Facilities	57.47	27.81	-0.97	-6.59	-0.82	-0.93	-0.09	-9.40
Adjustments[d]			13.12	76.21	11.26	12.18	0.89	113.64
Subtotal Vegetation Clearing Impacts	*1,710.58*	*533.67*	*-10.51*	*-74.27*	*-2.35*	*-86.59*	*-0.09*	*-173.89*
Total PSA FCU Post-construction Debits[e]			**-203.23**	**-625.06**	**-15.89**	**-2,298.40**	**-0.09**	**-3,142.74**

Combining All Individual Facility Adjusted Debit Table Results
We Can Quantify Wetland Impacts from the Proposed Project by Function

Projected "Debits" by Function, Donlin Gold Project

		FSA	+	PSA	=	Total
Model 1 FCUs: ModGWDischarge	=	-2,134	+	-338	=	- 2,472
Model 2 FCUs: ModGWRecharge	=	-1,992	+	-289	=	-2,281
Model 3 FCUs: StrFlodStorage	=	-2,891	+	-625	=	-3,516
Model 4 FCUs: ModStrFlow	=	-194	+	- 60	=	-254
Model 5 FCUs: ModWaQuality	=	-3,411	+	-624	=	-4,035
Model 6 FCUs: ExpDetritus	=	- 319	+	- 99	=	-418
Model 7 FCUs: Abund&DiverVeg	=	-3,990	+	-591	=	-4,581
Model 8 FCUs: Abund&DiverFauna	=	-3,086	+	-517	=	-3,603
Total FCU Debits	**=**	**- 18,018**	**+**	**-3,143**	**=**	**-21,160**

Total Wetland Impacts Evaluated = 7,051 Acres (Max FCUs = -56,408)

Total Impacts Not Evaluated = 33.57 Acres
Small Streams
Small Drainages

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Subtracting the Projected "Debits" from the Baseline Condition "Credits" We Can Estimate the Percent Change in Condition for areas Mapped by Ecoregion, HUC10, etc. -- before CMP Efforts

			Baseline Credits	Project Debits		~Percent Change
Model 1 FCUs:	ModGWDischarge	=	56,671	-2,472	=	- 4.36%
Model 2 FCUs:	ModGWRecharge	=	43,376	-2,281	=	- 5.26%
Model 3 FCUs:	StrFlodStorage	=	103,434	-3,516	=	- 3.40%
Model 4 FCUs:	ModStrFlow	=	10,752	-254	=	- 2.36%
Model 5 FCUs:	ModWaQuality	=	97,730	-4,035	=	- 4.13%
Model 6 FCUs:	ExpDetritus	=	19,182	-418	=	- 2.18%
Model 7 FCUs:	Abund&DiverVeg	=	99,909	-4,581	=	- 4.59%
Model 8 FCUs:	Abund&DiverFauna	=	74,718	-3,603	=	- 4.82%
Totals		**=**	**505,773**	**-21,160**	**=**	**- 4.18%**

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How the CMP Data will Be Used in the Process

			Baseline Credits	-	Impact Debits	+	Mitigation Credits	=	No Significant Impact
Model 1 FCUs:	ModGWDischarge	=	56,671	-	2,472	+	TBD		
Model 2 FCUs:	ModGWRecharge	=	43,376	-	2,281	+	TBD		
Model 3 FCUs:	StrFlodStorage	=	103,434	-	3,516	+	TBD		
Model 4 FCUs:	ModStrFlow	=	10,752	-	254	+	TBD		
Model 5 FCUs:	ModWaQuality	=	97,730	-	4,035	+	TBD		
Model 6 FCUs:	ExpDetritus	=	19,182	-	418	+	TBD		
Model 7 FCUs:	Abund&DiverVeg	=	99,909	-	4,581	+	TBD		
Model 8 FCUs:	Abund&DiverFauna	=	74,718	-	3,603	+	TBD		
Total FCUs		**=**	**505,773**	**-**	**21,160**	**+**	**TBD**		

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Can/should we trade "apples for oranges" and if so, how would that be approached?

Regulatory decision, but need to determine appropriate "exchange rates." Some will be easier to figure out than others….but its just math…

Amazing logistical support by Donlin Gold staff and subcontractors made this effort possible. We can't name them all, but they kept the crew safe, rested, and well fed!